invensys
Eurotherm

nanodac™

User Guide

nanodac™ recorder/controller
Versions 2.0 and later

HA030554/1
July 2010

© 2010 Eurotherm Limited

All rights are strictly reserved. No part of this document may be reproduced, modified, or transmitted in any form by any means, nor may it be stored in a retrieval system other than for the purpose to act as an aid in operating the equipment to which the document relates, without the prior, written permission of Eurotherm Limited.

Eurotherm Limited pursues a policy of continuous development and product improvement. The specification in this document may therefore be changed without notice. The information in this document is given in good faith, but is intended for guidance only. Eurotherm Limited will accept no responsibility for any losses arising from errors in this document.

invensys
Eurotherm

Declaration of Conformity

Manufacturer's name:	**Eurotherm Limited**
Manufacturer's address:	**Faraday Close, Worthing, West Sussex, BN13 3PL, United Kingdom.**
Product type:	**Recorder / controller**
Models:	**nanodac Status level A1 upwards**
Safety specification:	**EN61010-1: 2001**
EMC emissions specification:	**EN61326-1: 2006 Class B**
EMC immunity specification:	**EN61326-1: 2006 Industrial locations**

Eurotherm Limited hereby declares that the above products conform to the safety and EMC specifications listed. Eurotherm Limited further declares that the above products comply with the EMC directive 2004/108/EC, and also with the Low Voltage Directive 2006/95/EC.

Signed: K Shaw Dated: 06/07/10

Signed for and on behalf of Eurotherm Limited
Kevin Shaw
(R&D Director)

CE

IA249986U790 Issue 1 Jly10 (CN26217)

Restriction of Hazardous Substances (RoHS)

Product group nanodac

Table listing restricted substances

Chinese

限制使用材料一览表

产品 nanodac	有毒有害物质或元素					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
印刷线路板组件	X	O	O	O	O	O
附属物	O	O	O	X	O	O
显示器	O	O	O	O	O	O
O	表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。					
X	表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。					

English

Restricted Materials Table

Product nanodac	Toxic and hazardous substances and elements					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
PCBA	X	O	O	O	O	O
Enclosure	O	O	O	X	O	O
Display	O	O	O	O	O	O
O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.					
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.					

Approval

Name:	Position:	Signature:	Date:
Martin Greenhalgh	Quality Manager	Martin Greenhalgh	11th April 2010

IA029470U790/1 (CN26215)

nanodac Recorder/Controller

User Guide

List of sections

Section		Page
1	Introduction	3
2	Installation	3
3	Operation	6
4	Configuration	26
5	Modbus TCP slave comms	72
6	iTools	107
7	User Wiring	126
A	Technical specification	131
B	Control Loops	137
C	Reference	163
Index		i

Associated documents

HA028838 . . . . . Printable version of iTools Help
HA025464 . . . . . EMC installation guidelines

nanodac Recorder/Controller

User Guide

Contents List

Section	Page
List of sections	i
Associated documents	i
SAFETY NOTES	**1**
USB MEMORY STICK PRECAUTIONS	2
32-BIT RESOLUTION	2
SYMBOLS USED ON THE RECORDER LABELLING	2
1 INTRODUCTION	**3**
1.1 UNPACKING THE INSTRUMENT	3
2 INSTALLATION	**3**
2.1 MECHANICAL INSTALLATION	3
2.1.1 Installation procedure	3
2.1.2 Demounting	3
2.2 ELECTRICAL INSTALLATION	5
2.2.1 Termination details	5
3 OPERATION	**6**
3.1 INTRODUCTION	6
3.1.1 Display screen	6
3.1.2 Navigation pushbuttons	7
PAGE BUTTON	7
SCROLL BUTTON	7
RAISE/LOWER BUTTONS	7
3.2 PROCESS VARIABLE DISPLAY	8
3.2.1 Alarm icons	8
3.2.2 Status bar Icons	9
SYSTEM ALARMS	9
CHANNEL ALARM	11
CHANGE BATTERY	11
USB	11
FTP ICON	11
RECORD ICON	11
MESSAGE ICON	11
AUTOTUNE ICON	11
3.3 TOP LEVEL MENU	12
3.3.1 Home	12
3.3.2 Configuration	12
3.3.3 Goto View	12
ALARM SUMMARY	13
SYSTEM ALARMS	13
MESSAGE SUMMARY	14
DISPLAY MODE SELECTION	15
3.3.4 History	15
3.3.5 Faceplate Cycling on/off	15
3.3.6 Operator Notes	15
CUSTOM NOTE	15
3.3.7 Login	15
LOGGED OUT ACCESS LEVEL	15
OPERATOR ACCESS LEVEL	15
SUPERVISOR ACCESS LEVEL	16
ENGINEER ACCESS LEVEL	16
LOGIN PROCEDURE	16
3.3.8 Demand Archive	17
ARCHIVE MENU	17
FTP SERVER ARCHIVING	18
3.4 DISPLAY MODES	19
3.4.1 Vertical trend	19
3.4.2 Horizontal Trend mode	20

List of Contents (Cont.)

Section Page

3.4.3 Vertical Bargraph mode 20
3.4.4 Horizontal Bargraph mode 21
3.4.5 Numeric mode 21
3.4.6 Control Loop1/Loop2 22
EDITING TECHNIQUES 22
3.4.7 Promote list 23
PARAMETER SELECTION 23
3.5 TREND HISTORY 24
3.5.1 Navigation 24
3.5.2 Options menu 24
3.6 TEXT ENTRY 25
3.6.1 Numeric keyboard 25
4 CONFIGURATION 26
4.1 INSTRUMENT MENU 27
4.1.1 Clock 27
4.1.2 Locale 28
4.1.3 Display configuration 29
4.1.4 Info menu 30
4.1.5 Upgrade 31
4.1.6 Security menu 32
4.1.7 Input adjust 33
ADJUSTMENT PROCEDURE 33
REMOVAL PROCEDURE 34
4.2 NETWORK MENU 35
4.2.1 Interface 35
4.2.2 Archiving 36
4.2.3 FTP Server 38
4.2.4 Modbus TCP 39
4.3 GROUP CONFIGURATION 40
4.3.1 Group Trend configuration 40
4.3.2 Group Recording configuration 41
4.4 INPUT CHANNEL CONFIGURATION 42
4.4.1 Channel Main 43
4.4.2 Channel Trend configuration 46
SPAN EXAMPLE 46
CHANNEL CONFIGURATION EXAMPLE 46
4.4.3 Alarm 1 menu 47
4.4.4 Alarm 2 menu 48
4.4.5 Alarm types 49
ABSOLUTE ALARMS 49
DEVIATION ALARMS 49
RATE-OF-CHANGE ALARMS 50
4.5 VIRTUAL CHANNEL CONFIGURATION 51
4.5.1 Maths channel configuration 51
MATHS FUNCTIONS 52
4.5.2 Totaliser configuration 53
4.5.3 Counter configuration 55
4.6 LOOP CONFIGURATION 56
4.6.1 Main menu parameters 57
4.6.2 Setup menu parameters 57
4.6.3 Tune menu parameters 58
4.6.4 PID menu parameters 59
4.6.5 Setpoint menu parameters 60
4.6.6 Output menu items 61
4.6.7 Loop diagnostics 63
4.7 DIGITAL I/O 64
4.7.1 Digital input/output 64
4.7.2 Relay outputs 64
4.7.3 Digital inputs 65
4.8 USER LIN 66
4.8.1 User linearisation table rules 66

List of Contents (Cont.)

Section Page

4.9 CUSTOM MESSAGES 66
4.10 ZIRCONIA BLOCK (OPTION) 67
4.10.1 Definitions 67
Temperature Control 67
Carbon Potential Control 67
Sooting Alarm 67
Automatic Probe Cleaning 67
Endothermic Gas Correction 67
Clean Probe 67
OXYGEN CONCENTRATION 67
4.10.2 Configuration 68
ZIRCONIA MAIN 68
MAIN PARAMETERS 69
GAS REFERENCES PARAMETERS 70
CLEAN PARAMETERS 70
4.10.3 Wiring 71
4.11 ALARM SUMMARY 71
5 MODBUS TCP SLAVE COMMS 72
5.1 INSTALLATION 72
5.2 INTRODUCTION 72
5.2.1 Function Codes 72
DIAGNOSTIC CODES 72
EXCEPTION CODES 73
5.2.2 Data types 73
DATA ENCODING 73
5.2.3 Invalid multiple register writes 73
5.2.4 Master communications timeout 73
5.2.4 Non-volatile parameters in EEPROM 74
5.3 PARAMETER LIST 76
DIGITAL I/O ASSIGNMENTS 76
6 iTOOLS 107
6.1 iTools CONNECTION 107
6.1.1 Ethernet (Modbus TCP) communications 108
6.1.2 Direct Connection 110
WIRING 110
6.2 SCANNING FOR INSTRUMENTS 111
6.3 GRAPHICAL WIRING EDITOR 112
6.3.1 Tool bar 113
6.3.2 Wiring editor operating details 113
COMPONENT SELECTION 113
FUNCTION BLOCKS 114
WIRES 116
COMMENTS 117
MONITORS 118
COLOURS 119
DIAGRAM CONTEXT MENU 119
COMPOUNDS 120
TOOL TIPS 120
6.4 PARAMETER EXPLORER 121
6.4.1 Parameter explorer detail 122
6.4.2 Explorer tools 123
6.4.3 Context Menu 123
6.5 WATCH/RECIPE EDITOR 124
6.5.1 Creating a Watch List 124
ADDING PARAMETERS TO THE WATCH LIST 124
DATA SET CREATION 124
6.5.2 Watch Recipe toolbar icons 125
6.5.3 Watch/Recipe Context Menu 125
7 USER WIRING 126
7.1 DRIVE RELAY EXAMPLE 126
7.1.1 Wire removal 127

List of Contents (Cont.)

Section Page

7.2 COUNTER EXAMPLE 128
Appendix A: TECHNICAL SPECIFICATION 131
A1 INSTALLATION CATEGORY AND POLLUTION DEGREE 131
Installation category II 131
Pollution degree 2 131
A2 RECORDER SPECIFICATION 132
A3 ANALOGUE INPUT SPECIFICATION 133
A4 RELAY AND LOGIC I/O SPECIFICATION 135
A5 DIGITAL INPUTS 135
A6 BLOCKS SUPPORTED 135
A6.1 FUNCTION BLOCKS 135
A6.2 APPLICATION BLOCKS 135
Appendix B CONTROL LOOPS 137
B.1 INTRODUCTION 137
B1.1 EXAMPLE (HEAT ONLY) 137
B2 CONTROL LOOP DEFINITIONS 137
B2.1 AUTO/MANUAL 137
B2.2 TYPES OF CONTROL LOOP 138
B2.2.1 On/Off control 138
B2.2.2 PID Control 138
PROPORTIONAL BAND 138
INTEGRAL TERM 139
DERIVATIVE TERM 139
B2.2.3 Motorised valve control 140
MANUAL MODE 140
MOTORISED VALVE OUTPUT CONNECTIONS 140
B2.3 LOOP PARAMETERS 141
B2.3.1 Relative cool gain (R2G) 141
B2.3.2 High and Low cutback 141
B2.3.3 Manual Reset 141
B2.3.4 Integral Hold 142
B2.3.5 Integral De-bump 142
B2.3.6 Loop Break 142
B2.3.7 Gain Scheduling 143
B2.4 TUNING 143
B2.4.1 Introduction 143
B2.4.2 Loop Response 144
UNDER DAMPED 144
CRITICALLY DAMPED 144
OVER DAMPED 144
B2.4.3 Initial Settings 144
SETPOINT 144
OUTPUT HIGH, OUTPUT LOW 144
REM. OUTPUT LOW, REM. OUTPUT HIGH 144
Ch2 DeadBand 144
MINIMUM ON TIME 144
FILTER 144
RATE 145
CH1 TRAVEL TIME, CH2 TRAVEL TIME 145
B2.4.4 Other tuning considerations 145
B2.4.5 Autotune 145
AUTOTUNE AND SENSOR BREAK 146
AUTOTUNE AND INHIBIT 146
AUTOTUNE AND GAIN SCHEDULING 146
INITIAL CONDITIONS 146
INITIATING THE AUTOTUNE 146
EXAMPLE 1: AUTOTUNE FROM BELOW SP (HEAT/COOL) 147
EXAMPLE 2: AUTOTUNE FROM BELOW SP (HEAT ONLY) 148
EXAMPLE 3: AUTOTUNE AT SP (HEAT /COOL) 149
AT.R2G 150

List of Contents (Cont.)

Section Page

FAILURE MODES . . . 151
B2.4.6 Manual tuning . . . 151
CUTBACK VALUES . . . 152
B2.5 SETPOINT . . . 153
B2.5.1 Setpoint function block . . . 153
B2.5.2 Setpoint Limits . . . 154
B2.5.3 Setpoint Rate Limit . . . 154
B2.5.4 Setpoint Tracking . . . 155
B2.5.5 Manual Tracking . . . 155
B2.6 OUTPUT . . . 156
B2.6.1 Introduction . . . 156
B2.6.2 Output Limits . . . 156
B2.6.3 Output Rate Limit . . . 157
B2.6.4 Sensor Break Mode . . . 157
SAFE . . . 157
HOLD . . . 157
B2.6.5 Forced Output . . . 157
B2.6.6 Power Feed Forward . . . 158
B2.6.7 Cool Type . . . 158
LINEAR . . . 158
OIL COOLING . . . 158
WATER COOLING . . . 158
FAN COOLING . . . 158
B2.6.8 Feed forward . . . 159
B2.6.9 Effect of Control Action, Hysteresis and Deadband . . . 159
CONTROL ACTION . . . 159
HYSTERESIS . . . 159
DEADBAND . . . 159
B2.6.10 Valve nudge . . . 161
B2.6.11 Time Proportioning . . . 162
B2.7 DIAGNOSTICS . . . 162
Appendix C: REFERENCE . . . 163
C1 BATTERY REPLACEMENT . . . 163
C2 SETTING UP AN FTP SERVER USING FILEZILLA . . . 164
C2.1 DOWNLOADING . . . 164
C2.2 SERVER SETUP . . . 166
C2.3 PC SETUP . . . 167
C2.4 RECORDER/CONTROLLER SET UP . . . 167
C2.5 ARCHIVE ACTIVITY . . . 168
C3 FUNCTION BLOCK DETAILS . . . 169
C3.1 EIGHT INPUT OR BLOCK . . . 169
C4 TCP PORT NUMBERS . . . 170
C5 ISOLATION DIAGRAM . . . 170
Index . . . i

SAFETY NOTES

WARNINGS

1. Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.
2. Live sensors: The unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. It must be ensured that service personnel do not touch connections to such inputs whilst the inputs are live. with live sensors, all cables, connections and switches for connecting the sensor must be mains rated for use in 240V Cat II.
3. Grounding the temperature sensor shield: Where it is common practice to replace the temperature sensor whilst the instrument is live, it is recommended that the shield of the temperature sensor be grounded to safety earth, as an additional protection against electric shock.
4. The instrument must not be wired to a three-phase supply with an unearthed star connection, because, under fault conditions, such a supply could rise above 240V RMS with respect to ground, thus rendering the instrument unsafe.

Notes:

1. Safety requirements for permanently connected equipment state:
   a. A switch or circuit breaker shall be included in the building installation.
   b. It shall be in close proximity to the equipment and within easy reach of the operator.
   c. It shall be marked as the disconnecting device for the equipment.
2. Recommended external fuse ratings are: 2A Type T 250V.

1. This instrument is intended for industrial temperature and process control applications within the requirements of the European directives on safety and EMC.
2. Installation may be carried out only by qualified personnel.
3. To prevent hands or metal tools coming into contact with parts that are electrically live the instrument must be installed in an enclosure.
4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the enclosure.
5. The mains supply fuse within the power supply is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.
6. Whenever it is likely that protection has been impaired, the unit shall be made inoperative, and secured against accidental operation. The manufacturer's nearest service centre should be contacted for advice.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. The unit must be wired according to the instructions in this manual.
9. Before any other connection is made, the protective earth terminal shall be connected to a protective conductor. The mains (supply voltage) wiring must be terminated in such a way that, should it slip, the Earth wire would be the last wire to become disconnected. The protective earth terminal must remain connected (even if the equipment is isolated from the mains supply), if any of the I/O circuits are connected to hazardous voltages*.
   The protective earth connection must always be the first to be connected and the last to be disconnected.
   Wiring must comply with all local wiring regulations, e.g. in the UK, the latest IEEE wiring regulations (BS7671) and in the USA, NEC class 1 wiring methods.
10. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.

* A full definition of 'Hazardous' voltages appears under 'Hazardous live' in BS EN61010. Briefly, under normal operating conditions, hazardous voltages are defined as being > 30V RMS (42.2V peak) or > 60V dc.

SAFETY NOTES (Cont.)

11. The maximum continuous voltage applied between any of the following terminals must not exceed 240Vac.
    1. Relay output to logic, dc or sensor input connections
    2. Any connection to ground.

    The ac supply must not be connected to sensor input or low-level inputs or outputs.
12. Over temperature protection: A separate over-temperature protection unit (with an independent temperature sensor) should be fitted to isolate the process heating circuit should a fault condition arise.

    Alarm relays within the recorder/controller do not give protection under all fault conditions/
13. In order to allow the power supply capacitors to discharge to a safe voltage, the supply must be disconnected at least two minutes before the instrument is removed from its sleeve. The touching of the exposed electronics of an instrument which has been removed from its sleeve should be avoided.
14. Instrument labels may be cleaned using iso-propyl alcohol, or water or water-based products. A mild soap solution may be used to clean other exterior surfaces.

USB MEMORY STICK PRECAUTIONS

Note: the use of U3 USB Flash drives is not recommended.

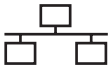
1. Precautions against electrostatic discharge should be taken when the instrument terminals are being accessed. The USB and Ethernet connections are particularly vulnerable.
2. Ideally, the USB memory stick should be plugged directly into the instrument, as the use of extension leads may compromise the instrument's ESD compliance. Where the instrument is being used in an electrically 'noisy' environment however, it is recommended that the user brings the USB socket to front of panel using a short extension lead. This is because the USB may 'lock up' or reset in noisy environments and the only means of recovery is to remove the device, then re-insert it. EMC-related failure during a write operation might cause corruption of the data held on a USB memory stick. For this reason, the data on the memory stick should be backed up before insertion and checked after removal.
3. When using a USB extension cable, a high quality screened cable must be used with a maximum length of 3 metres (10 ft.)

32-BIT RESOLUTION

Floating point values are stored in IEEE 32-bit single precision format. Values which require greater resolution than is available in this format are rounded up or down.

SYMBOLS USED ON THE RECORDER LABELLING

One or more of the symbols below may appear as a part of the recorder labelling.

	Refer to manual for instructions		Risk of electric shock
	This unit is CE approved		Precautions against static electrical discharge must be taken when handling this unit
	C-Tick mark for Australia (ACA) and New Zealand (RSM)		Ethernet connector
	Underwriters laboratories listed mark for Canada and the U.S.A.		USB connector
	For environmental reasons, this unit must be recycled before its age exceeds the number of years shown in the circle.		Protective conductive terminal (Safety Earth)

1 INTRODUCTION

This document describes the installation, operation and configuration of a paperless graphic recorder/controller. The instrument comes with four input channels and is equipped, as standard, for secure archiving via FTP transfer and/or to USB memory stick.

1.1 UNPACKING THE INSTRUMENT

The instrument is despatched in a special pack, designed to give adequate protection during transit. Should the outer box show signs of damage, it should be opened immediately, and the contents examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions. After the instrument has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. The packing should then be stored against future transport requirements.

2 INSTALLATION

2.1 MECHANICAL INSTALLATION

Figure 2.1 gives installation details.

2.1.1 Installation procedure

1. If it is not already in place, fit the IP65 sealing gasket behind the front bezel of the instrument.
2. Insert the instrument through the panel cutout, from the front of the panel.
3. Spring the retaining clips into place, and secure the instrument by holding it firmly in place whilst pushing both clips towards the rear face of the panel.
4. The protective membrane can now be removed from the display.

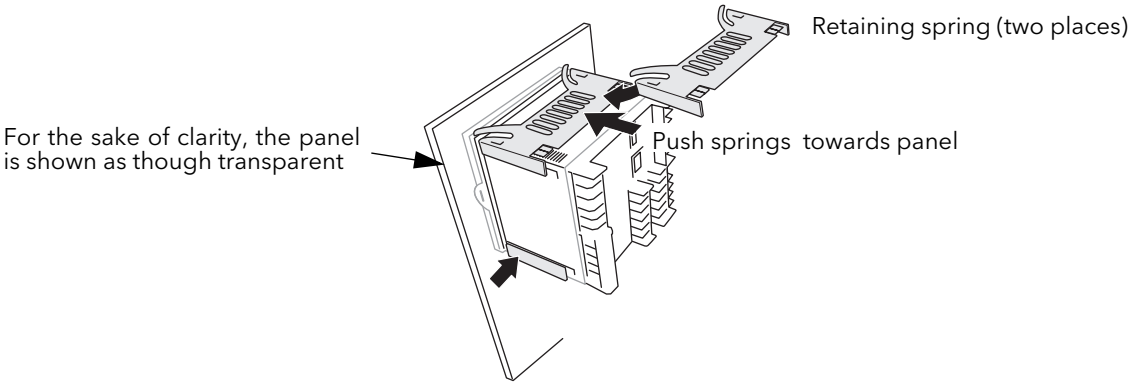

Retaining spring (two places)
For the sake of clarity, the panel is shown as though transparent
Push springs towards panel

Figure 2.1.1 Securing the instrument

2.1.2 Demounting

WARNING

Before removing the supply voltage wiring, isolate the supply voltage and secure it against unintended operation.

1. Isolate the mains supply and secure it against accidental operation. Remove all wiring and the USB device and Ethernet cable (if any).
2. Remove the retaining springs by unhooking them from the sides using a small flat-blade screwdriver.
3. Pull the instrument forwards out of the panel.

Note: See section C1 (Battery replacement) for a more detailed description

2 MECHANICAL INSTALLATION (Cont.)

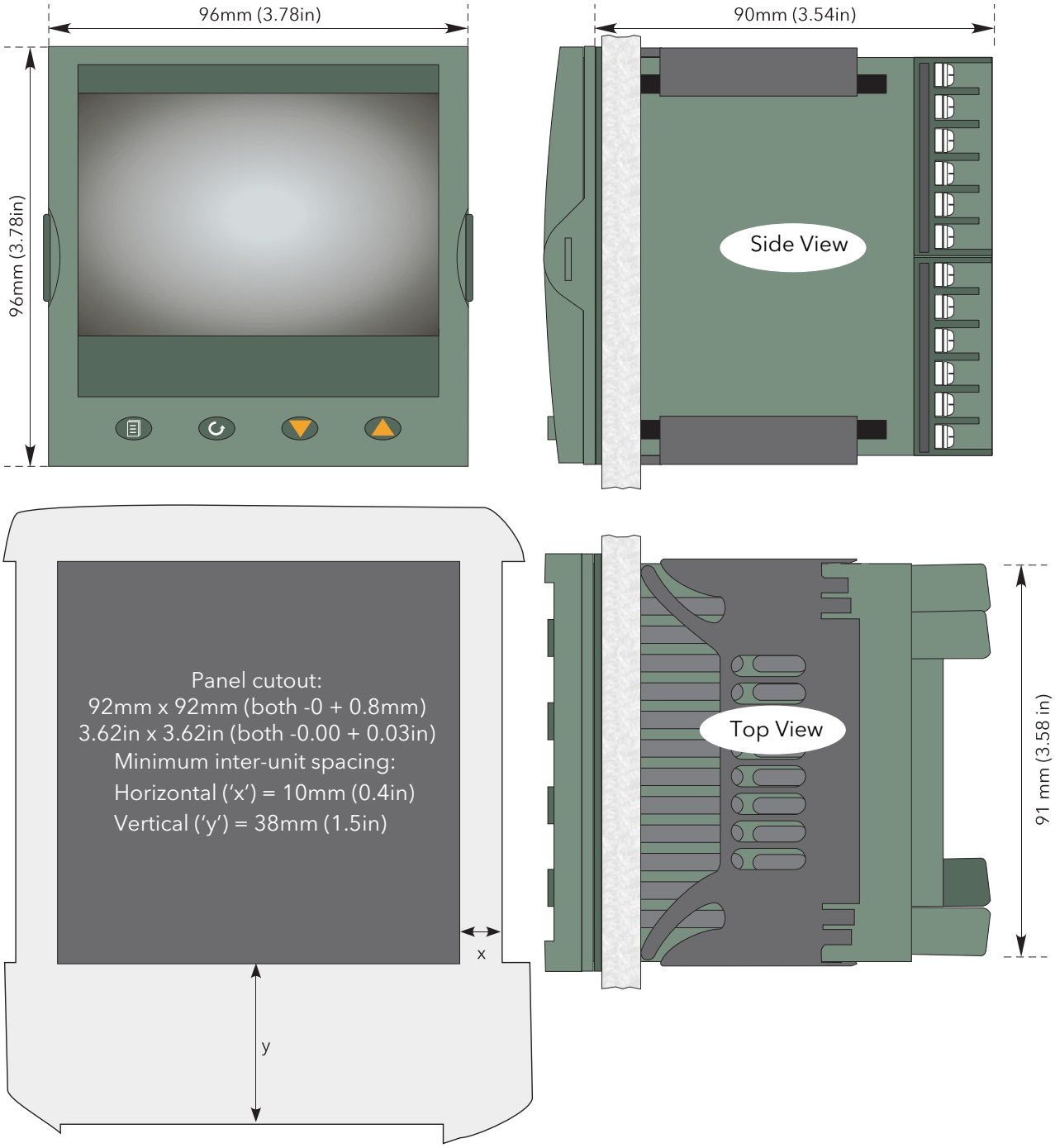


Figure 2.1 Mechanical installation details

2.2 ELECTRICAL INSTALLATION

Figure 2.2 shows the locations of the various user terminations along with signal and supply wiring pinouts.

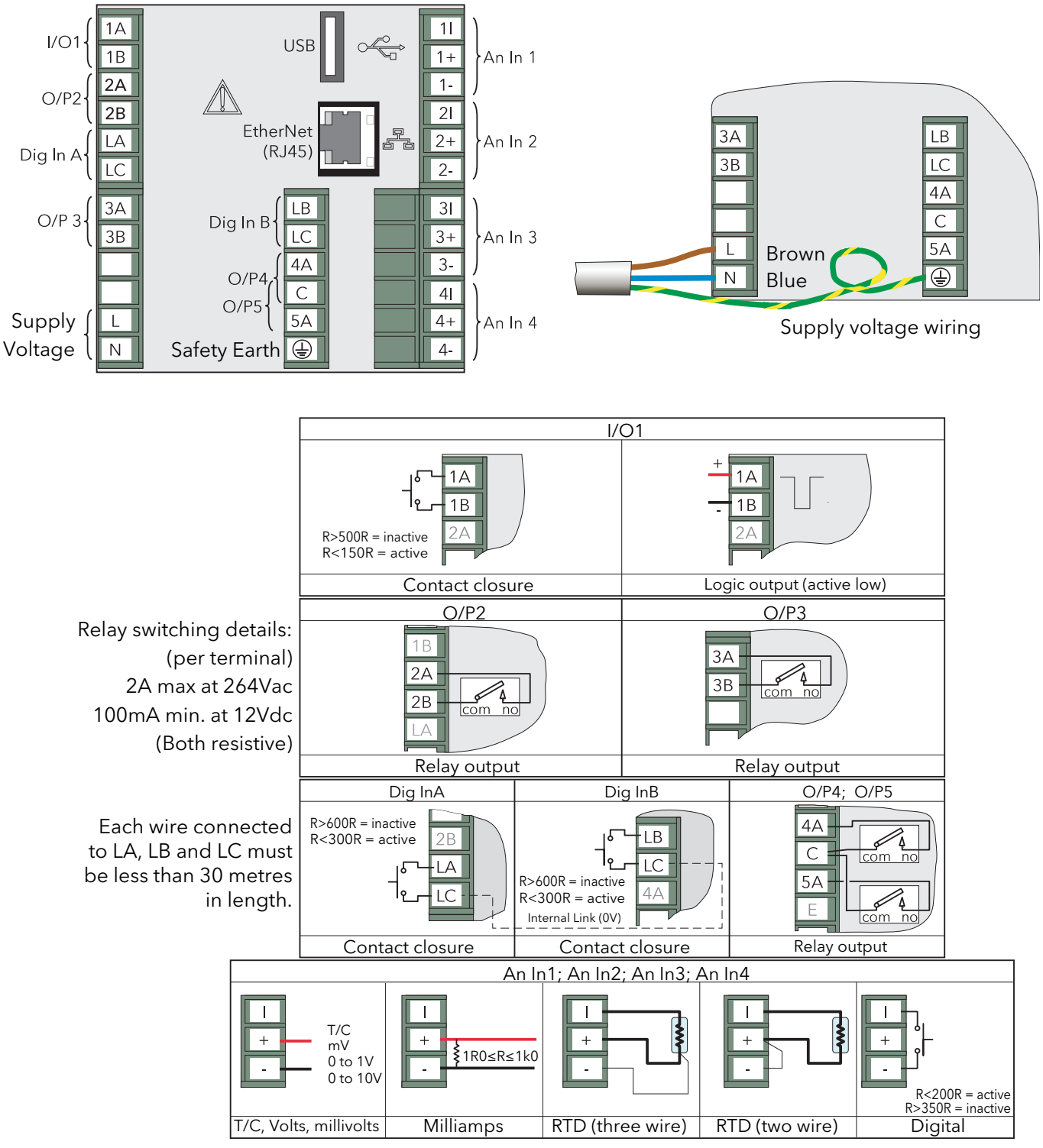


Figure 2.2 Connector locations and pinouts (rear panel)

2.2.1 Termination details

The screw terminals accept single wires in the range 0.21 to 2.08 mm^2 (24 to 14 AWG) inclusive, or two wires each in the range 0.21 to 1.31 mm^2 (24 to 16 AWG) inclusive.

Screw terminals should be tightened to a torque not exceeding 0.4Nm (3.54 lb in)

3 OPERATION

3.1 INTRODUCTION

The operator interface consists of a display screen and four push buttons.

3.1.1 Display screen

The display screen is used both to display channel information (in one of a number of display modes), and to display the various configuration screens which allow the user to setup the recorder to display the required channels, to set up alarms and so on. Display modes are described in section 3.4, below; configuration is described in section 4.

In display mode, the screen is split horizontally into three areas (figure 3.1.1)

1. a faceplate giving channel details.
2. the main display screen showing channel traces etc.
3. the status area, displaying instrument name, the current time and date and any system icons.

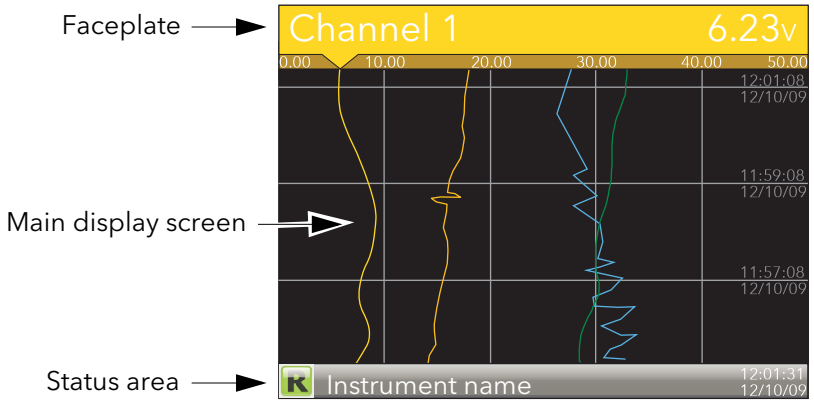


Figure 3.1.1 Display mode screen (vertical trend)

In configuration mode, the entire display screen is devoted to the selected configuration menu.

3.1.2 Navigation pushbuttons

There are four navigation buttons, called 'Page', 'Scroll', 'Lower' and 'Raise' located below the screen.

The general properties of these buttons are described in the remainder of this section, but some have additional, context sensitive functions, which, for the sake of clarity are not described here but in the relevant sections (e.g. 'Message summary') of the manual.

PAGE BUTTON

From any non-configuration page, pressing this push button causes the top level menu (figure 3.1.2) to appear. The figure shows the menu for a user logged in with 'Engineer' level access. Other access levels may have fewer menu items.

Within configuration pages, the Scroll button can be used as an enter key to select lower menu levels. In such cases the page button is used to reverse this action, moving the user up one menu level per operation.

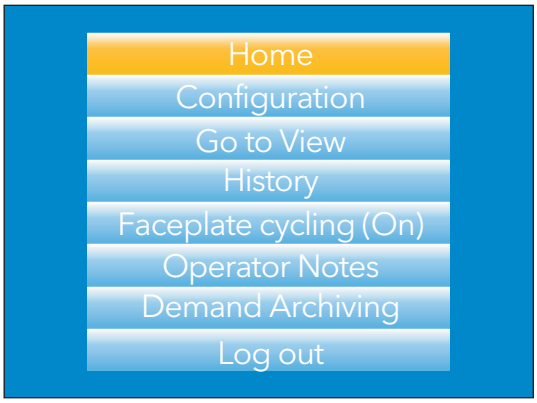


Figure 3.1.2 Top level menu (Engineer level access)

SCROLL BUTTON

From trending pages, operation of the scroll pushbutton scrolls through the channels enabled in the group. The Faceplate cycling 'Off' selection can be used to keep a particular channel permanently displayed, and the scroll pushbuttons can then be used to select channels manually.

In configuration pages, the scroll key operates as an 'enter' key to enter the next menu level associated with the highlighted item. Once the lowest menu level is reached, operation of the scroll key allows the value of the selected item to be edited by the relevant means (for example, the raise/lower keys, or a keyboard entry).

The 'Page' key is used to move the user back up the menu structure, until the top level menu is reached, when the scroll key can be used again to return to the Home page.

The scroll button is also used to initiate user wiring as described in section 7

RAISE/LOWER BUTTONS

Within trending displays, the Raise and Lower keys can be used to scroll through the enabled display modes in the sequence: vertical trend, horizontal trend, vertical bargraph, horizontal bargraph, numeric, vertical trend... and so on.

Within configuration pages, these pushbuttons act as cursor keys, allowing, for example, the user to highlight menu items for selection using the scroll button, and in many cases allowing the user to select one from a number of alternative values within menu items. Theses keys are also used to navigate through the virtual keyboards (section 3.6) and number pads used to enter text or numeric strings.

3.2 PROCESS VARIABLE DISPLAY

As discussed above, the operator interface consists of a display screen and associated push buttons. The display screen shows process variables in one of a number of formats, or operational details (notes or alarm history for example), or configuration details for use in setting up the recorder to produce the required displays and history formats. The remainder of section three discusses the process variable displays, alarm displays and so on; configuration details are to be found in section 4.

Note: Some of the items below can be selected for use only by users with a suitable permission level as set up in the 'Instrument' 'Security' menu described in section 4.1.6

Figure 3.2 below, depicts a typical trend display and gives details of the various areas of the display page.

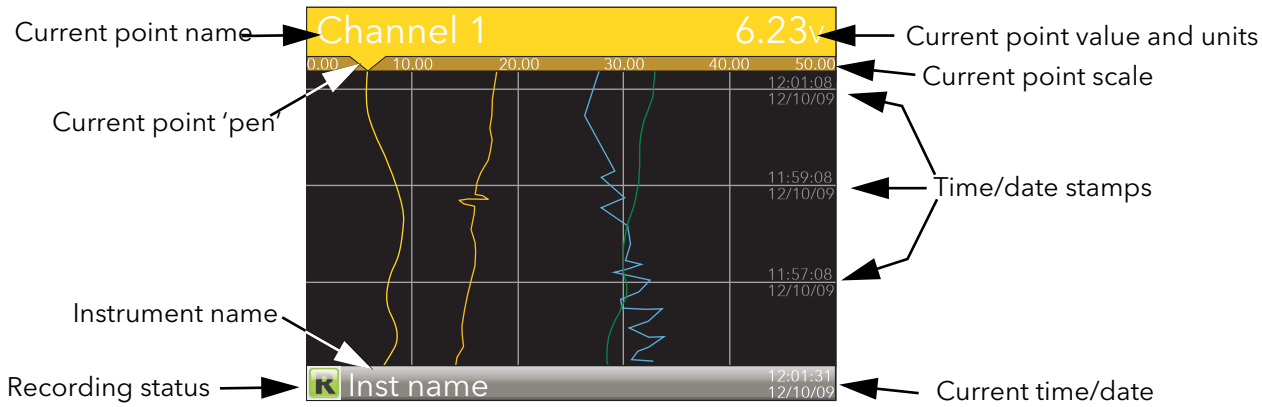


Figure 3.2 Typical display screen (Vertical trend)

Figure 3.2 shows a vertical trend page. Operating the Raise/Lower push-buttons allows the user to scroll through the other display modes: Horizontal trend, Vertical bargraph, horizontal bargraph, numeric, vertical trend... and so on. All these display modes are described in section 3.4, below.

A display mode can also be selected from the Top level menu 'Goto View' item which appears when the 'Page' key is operated.

The scroll button can be used to scroll through the points in the group, overriding the 'Faceplate Cycling' on or off selection

3.2.1 Alarm icons

Notes:

1. A full discussion of alarms is given in the Channel Configuration section of this manual (section 4.4.3)
2. Trigger alarms do not display threshold marks or bars, or faceplate symbols

The alarm icons shown below appear in some display modes. The icons on a channel faceplate show the status of that channel's alarm(s), as follows:

Icon is flashing	alarm is active but unacknowledged or it is an Auto alarm which is no longer active but which has not been acknowledged
Icon steadily illuminated	the alarm is active and has been acknowledged.

Alarm thresholds and deviation alarm bars appear for horizontal and vertical trend modes. For deviation bars, the bar stretches from (Reference - Deviation) to (Reference + Deviation). Vertical and Horizontal bargraph modes display only absolute alarm symbols.

3.2.1 ALARM ICONS (Cont.)

▲	Absolute High
▼	Absolute Low
▲	Deviation High
▼	Deviation Low
▲▼	Deviation Band
◢	Rising Rate of change
◣	Falling Rate of change
▲	Digital High
▼	Digital Low

Table 3.2.1 Alarm icons

3.2.2 Status bar Icons

The following items can appear in a dedicated window immediately to the left of the time and date, at the bottom right-hand corner of the display. The width of this window expands as the number of icons increases, and the instrument name is truncated, as necessary, to make room.

SYSTEM ALARMS

This indicator appears, flashing, if any one or more of the alarms listed below is active. The System Alarms summary page (accessed from 'Go to View in the top level menu) allows the user to view such system alarms as are active. It is not possible to 'acknowledge' system alarms

Archive Disabled	An unattended archiving strategy has temporarily been disabled.
Archiving Failed	An unattended archiving strategy has failed to complete.
Archiving Timeout	A configured archiving strategy has timed out.
Battery failure	Indicates that the battery is approaching the end of its useful life, or that it is missing or is completely exhausted.
Clock failure	The internal clock was found to be corrupt at power up, or that the time has never been set. Time is forced to 00:00 1/1/1900. Can be caused by battery failure, in which case the battery symbol is also visible and a battery failure message appears. The error is cleared by setting the time and date.
Channel error	Indicates a hardware failure in the channel circuit or in the internal cold junction temperature measurement.
Database failure	Corrupted EEPROM or flash memory.
DHCP Server failure	For units with 'IP Type' set to 'DHCP' (Network.Interface configuration) this alarm occurs if the instrument is unable to obtain an IP address from the server.
FTP Archiving file lost	A file has been deleted that had not yet been archived. Possible causes: Communications with the server could not be established,; archive is disabled; archive rate too slow.
FTP Archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Automatic' (Section 4.2.2) to ensure that data is not lost.

(Continued)

3.2.2 STATUS BAR ICONS (Cont.)

FTP Primary Server Failure	This error occurs if the recorder fails to establish connection with the primary server, after two attempts. After the second attempt fails, the recorder attempts to establish connection with the secondary server instead. Primary and secondary server details are entered in the Network.Archiving area of configuration (Section 4.2.2).
FTP Secondary Server Failure	This error occurs if the recorder fails to establish connection with the secondary server, after two attempts. Primary and secondary server details are entered in the Network.Archiving area of configuration (section 4.2.2).
Maths channel failure	Appears if, for example, the divisor of a divide function is zero.
Media archiving file lost	A file has been deleted that had not yet been archived. Possible causes: Memory stick missing, full or write protected; archiving has been disabled; archiving rate too slow.
Media archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Automatic' (Section 4.2.2) to ensure that data is not lost.
Media full	Archive storage device is full. The alarm becomes active only when an archive is in progress.
Media missing	No archive storage device present when archive attempted.
Non-volatile memory failure	RAM copy of non-volatile parameters is corrupted.
Recording failure (message)	Message explains reason for failure.
USB overcurrent	USB power fault - too much current (i.e. >100mA) is being drawn by a USB device.
Wiring failure	The user wiring has failed to verify, i.e. one or more wires has been detected that does not have both a source and a destination defined. This may be the result, for example, of power loss during a download from iTools.

3.2.2 STATUS BAR ICONS (Cont.)

CHANNEL ALARM

This indicator appears if any channel (including channels not in the display group) is in an alarm state. The symbol is illuminated continuously if all alarms are acknowledged or flashes if any one or more alarms is unacknowledged. Alarms are acknowledged from the Root menu 'Alarm summary' item as described in section 3.3.3 or in the Channel configuration area (Section 4.4.3) if the user's access permission is appropriate.

CHANGE BATTERY

This indicator first appears when the battery voltage (checked every 15 minutes) indicates that the battery is approaching the end of its useful life. The indicator remains on display until the battery is replaced (Appendix C; section C1). A System Alarm is also generated.

USB

This icon appears whenever a memory stick is plugged into the USB port at the rear of the recorder. When transfer is in progress, the icon changes to a 'busy' version.

CAUTION

The Memory stick must not be removed while archiving (demand or automatic) is in progress, as to do so may irreparably damage the file system of the memory stick, rendering it unusable. It is recommended that all archiving be suspended before the memory stick is removed.

FTP ICON

The FTP icon appears whenever transfer activity is taking place.

RECORD ICON

One of four icons appears at the bottom left corner of the display to indicate recording status.

Record

This indicates that the recorder is recording the items selected in the Group Recording area of configuration (section 4.3).

Stopped

This means that 'Enable' has been set to 'no' in the Group Recording area of configuration (section 4.3). Trending is not affected.

Paused (Suspended)

This means that recording has been paused by a wire to the Suspend parameter (Group Recording area of configuration (section 4.3)) going true (high). Trending is not affected.

In Configuration

The recorder has been placed in configuration mode either at the user interface, or via iTools. Recording is stopped until the recorder is no longer in configuration mode. For each non-recording state (Stopped, Paused or In Configuration) A new history file is created when the unit comes out of configuration mode.

MESSAGE ICON

This 'envelope' icon appears when a message is generated and it remains on display until the Message Summary is accessed, when it is removed from the display until the next new message is generated.

AUTOTUNE ICON

For instruments fitted with the Loop option, this symbol appears during the Autotune process.

3.3 TOP LEVEL MENU

This menu appears when the page key is operated from any non-configuration page. The menu items displayed depend on the access permission of the user. One of the menu items is highlighted, and if the scroll key is operated, then it is the highlighted item that is 'entered'.

Figure 3.3 shows the top level menu for Engineer level access.

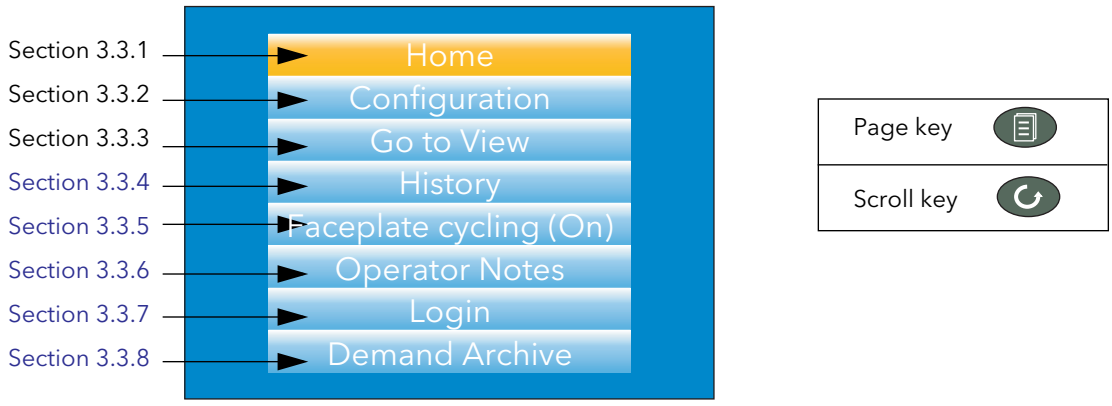


Figure 3.3 Top level menu

3.3.1 Home

Operating the scroll key whilst 'Home' is highlighted causes a return to the 'Home' page. By default, this is the vertical trend mode, but the mode can be changed in 'Instrument.Display' configuration (section 4.1.3)

3.3.2 Configuration

Operating the down arrow key highlights the 'Configuration' item. Operating the Scroll key enters the configuration submenu described in section 4 of this manual.

Note: 'Configuration' appears only if the user has an appropriate access level.

3.3.3 Goto View

Operating the scroll key whilst the 'Goto view' item is highlighted, calls the Goto view submenu (figure 3.3.3a). This allows the user to view channel alarms, system alarms, messages or to select a different display mode.

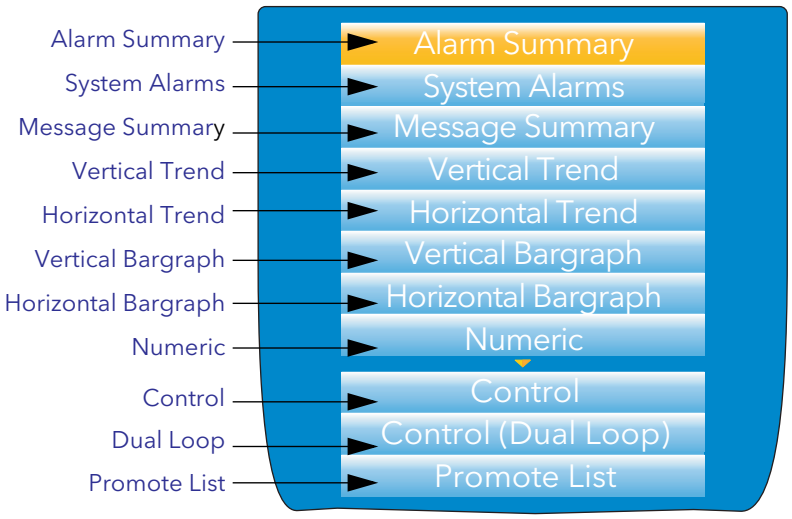


Figure 3.3.3a Goto view submenu

3.3.3 GOTO VIEW (Cont.)

ALARM SUMMARY

For each active alarm, this page displays the channel identifier with alarm number (e.g. C1(2) = channel 1; alarm 2), the channel descriptor, the alarm threshold the current process value and an alarm type symbol.

To return to the top level menu, operate the Page key.

Notes:

1. The background colour to the channel ID is the same as that chosen for the channel.
2. A prefix 'C' in the channel ID means that this is a measuring channel; A prefix 'V' means that this is a virtual channel (i.e. a totaliser, counter or maths channel)

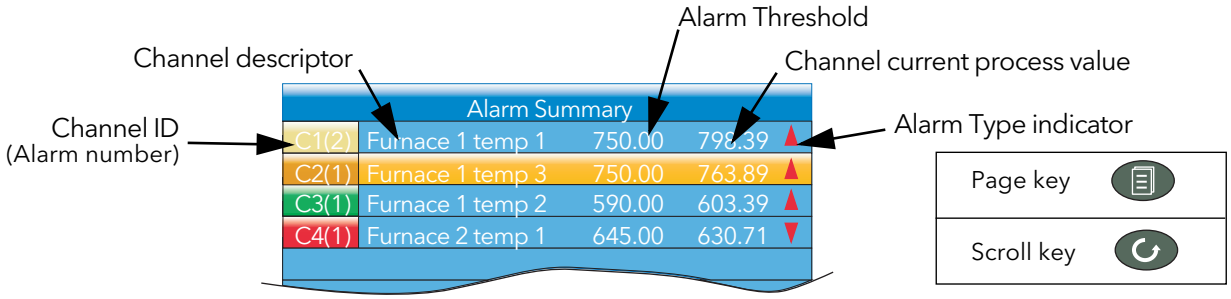


Figure 3.3.3b Alarm summary page with acknowledge confirmation display

ALARM ACKNOWLEDGEMENT

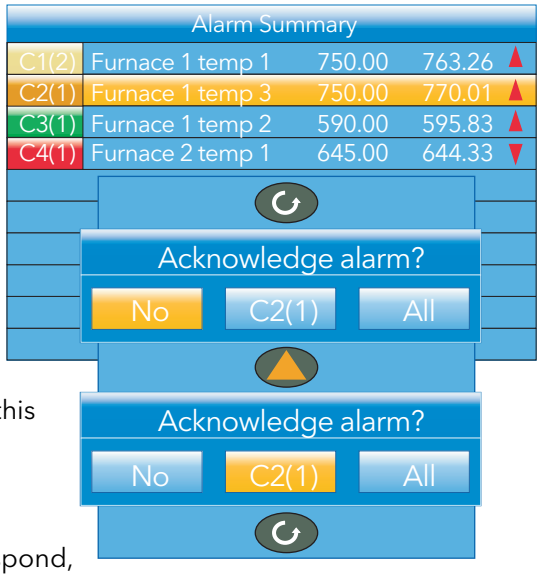
To acknowledge an alarm from this view:

1. Use the up and down arrows to highlight the required alarm

2. Operate the scroll button. The 'Acknowledge alarm' window appears.

3. Use the up arrow to highlight the relevant field (C2(1) in this example), or 'All' if all alarms are to be acknowledged.

4. Operate the scroll key to confirm. If the alarm fails to respond, this may be due to the fact that it has been configured as a 'Manual' alarm, and the trigger has not yet returned to a 'safe' (non-alarm) state, or it could be that the instrument is in a logged out state.


Alarm Summary
C1(2) Furnace 1 temp 1 750.00 763.26
C2(1) Furnace 1 temp 3 750.00 770.01
C3(1) Furnace 1 temp 2 590.00 595.83
C4(1) Furnace 2 temp 1 645.00 644.33
Acknowledge alarm?
No C2(1) All
Acknowledge alarm?
No C2(1) All

SYSTEM ALARMS

Operating the scroll button whilst the 'System Alarms' field is highlighted displays a list of all currently active system alarms. Section 3.2.2 contains a list of system alarms and their interpretations. To return to the top level menu, operate the Page key.

A further operation of the scroll button displays a 'Help Information' page, giving the reason for the highlighted alarm.

Operate the scroll button again to return to the system alarm display.

3.3.3 GOTO VIEW (Cont.)

MESSAGE SUMMARY

Operating the scroll key whilst the 'Message summary' field is highlighted displays the10 most recent messages. Operating the scroll key whilst a message is highlighted shows the selected message in more detail, and using the up/down keys allows the other messages to be scrolled through.

By default, the interface is set up such that:

1. all message types are included
2. the up and down arrow keys cause the highlighted selection to move up or down by one message at a time.

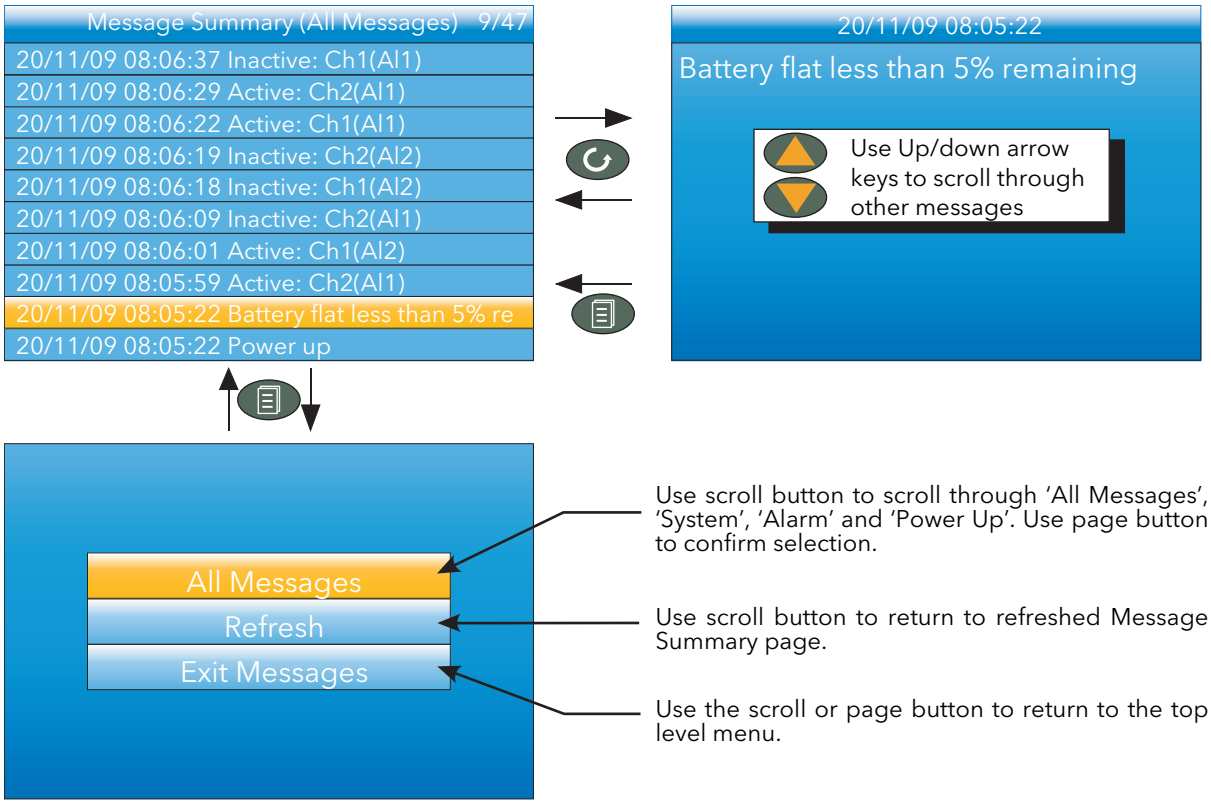
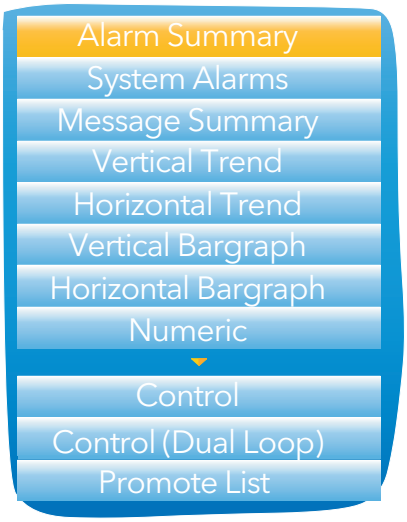

Message Summary (All Messages) 9/47
20/11/09 08:06:37 Inactive: Ch1(Al1)
20/11/09 08:06:29 Active: Ch2(Al1)
20/11/09 08:06:22 Active: Ch1(Al1)
20/11/09 08:06:19 Inactive: Ch2(Al2)
20/11/09 08:06:18 Inactive: Ch1(Al2)
20/11/09 08:06:09 Inactive: Ch2(Al1)
20/11/09 08:06:01 Active: Ch1(Al2)
20/11/09 08:05:59 Active: Ch2(Al1)
20/11/09 08:05:22 Battery flat less than 5% re
20/11/09 08:05:22 Power up
20/11/09 08:05:22
Battery flat less than 5% remaining
Use Up/down arrow keys to scroll through other messages
All Messages
Refresh
Exit Messages
Use scroll button to scroll through 'All Messages', 'System', 'Alarm' and 'Power Up'. Use page button to confirm selection.
Use scroll button to return to refreshed Message Summary page.
Use the scroll or page button to return to the top level menu.

Figure 3.3.3c Message summary features

MESSAGE FILTERS

All Messages	Causes all messages to be displayed on the screen.
System	Shows only system alarms
Alarm	Shows only channel alarms
Power up	Shows only power up messages
Login/out	Limits the display to Log in and Log out events.

3.3.3 GOTO VIEW (Cont.)



DISPLAY MODE SELECTION

Use the up/down arrow buttons to highlight the required display mode. Once the required display mode is highlighted, operation of the scroll button causes the recorder to leave the 'Go to' menu and to display channel values in the selected mode. See section 3.4 for a description of the various display modes.

Alternatively the up and down arrow buttons can be used from any of the display modes to cycle through the available modes in the order listed in the figure.

3.3.4 History

This top level menu item allows the user to switch from real-time trending to review mode, where channel values, messages, alarm triggers etc. can be viewed back as far as the last significant configuration change. History mode is fully discussed in section 3.5.

3.3.5 Faceplate Cycling on/off

For the purposes of this document the channel whose faceplate is currently displayed and whose 'pen' symbol is visible is called the 'Active' channel.

By default, the recorder scrolls through all the channels in the display group, with each channel becoming the active channel in turn. This top level menu 'Faceplate Cycling' item allows the user to inhibit this scrolling action such that the currently active channel remains active permanently, or until a manual scroll is performed using the scroll button (or until Faceplate Cycling is re-enabled).

'Faceplate Cycling' is highlighted by using the up/down arrow buttons. Once highlighted, the status can be changed from 'On' to 'Off' or *vice-versa* using the scroll button. Operation of the 'Page' button returns the user to the trend display.

3.3.6 Operator Notes

This area allows up to 10 notes to be created when logged in as Engineer, using either the text entry techniques described in section 3.6, or 'iTools' described in section 6. Once logged out, operating the scroll button whilst a note is highlighted calls a selection box allowing the user either to send that note to the chart, or to write a Custom Note.

CUSTOM NOTE

The Custom Note is written using the text entry techniques described in section 3.6. Once the note is complete, operation of the page button calls a confirmation display. The down arrow is used to highlight 'Yes', and when the scroll key is then operated, the message is sent to the chart. This custom message is not retained for further use, so if it is required on a regular basis, it is suggested that one of the Operator Notes 1 to 10 be configured (Engineer access level required) so that it may be used instead.

> Note: Each note can contain up to 100 characters.

3.3.7 Login

Login allows the user to enter a password in order to gain access to areas of the unit's configuration which are not available when the user is logged out.

LOGGED OUT ACCESS LEVEL

Logged out mode allows the user to select viewing mode, to view history, to view alarms, to toggle faceplate cycling on and off, to send notes, to suspend/resume USB archiving and to access the login process.

OPERATOR ACCESS LEVEL

In addition to the logged out features, Operator access level allows the user to acknowledge alarms, to edit notes and to perform demand archive operations.

By default, no password is required in order to enter Operator level, but a password can be set either at Supervisor level or at Engineer level.

3.3.7 LOGIN (Cont.)

SUPERVISOR ACCESS LEVEL

In addition to the logged out level function, this access level allows the user to view the recorder's configuration, and to edit some values (such as alarm thresholds). By default, there is no password required to enter Supervisor level, but a password can be set in the Instrument area of configuration, either at Supervisor level or at Engineer level.

ENGINEER ACCESS LEVEL

This allows full access to all areas of the recorder configuration. The default password is 100, but this can be edited in the Instrument area of configuration (section 4.1.5).

Note: recording is stopped for as long as the user is logged in at Engineer level, even if the recorder is not being configured. This is indicated by the Record icon at the bottom left corner of the process value display screen being replaced by the Configuration (wrench) icon.

Record icon

Configuration icon

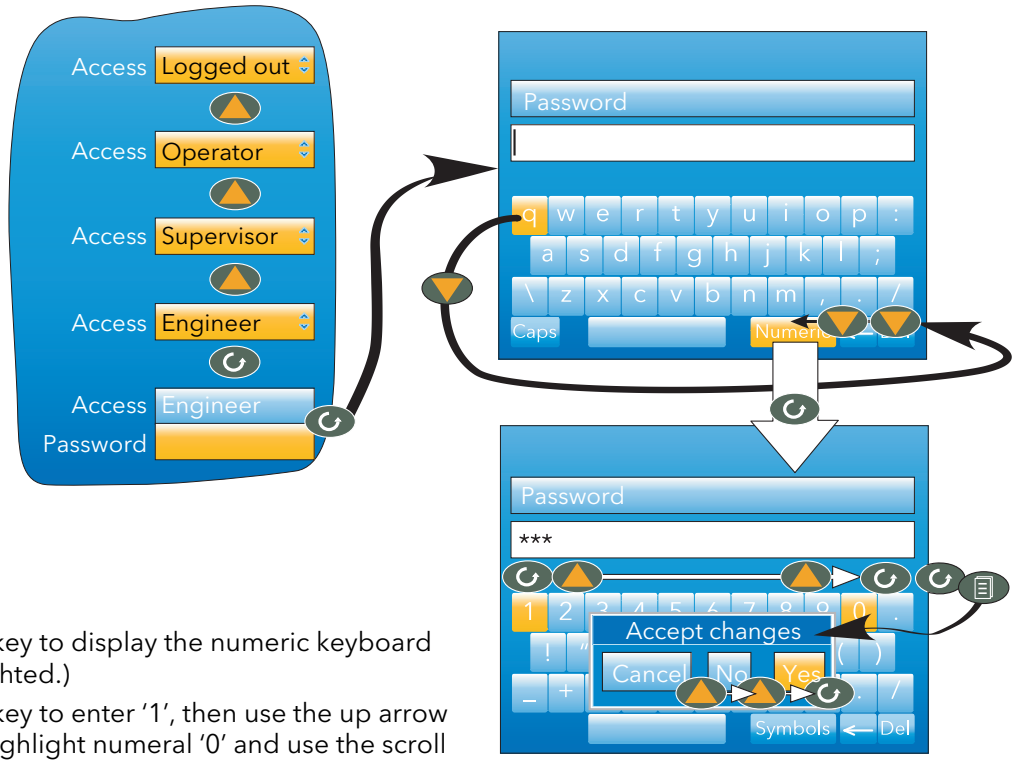
LOGIN PROCEDURE

From the top level menu, use the up or down arrow keys as often as necessary in order to highlight 'Login', and then operate the Scroll key to produce the 'Access Logged out' display.

Note: this procedure describes how to login to an access level with a password associated with it. For non-password protected logins, the user needs only to select the required access level, and press the scroll key.

To log in as Engineer (password = 100):

1. Operate the up arrow key three times, to display 'Engineer'.
2. Press the scroll key to call the 'alpha' keyboard, with the letter 'q' highlighted.
3. Use the down arrow key three times to highlight 'Numeric'.



4. Operate the scroll key to display the numeric keyboard (numeral '1' highlighted.)
5. Operate the scroll key to enter '1', then use the up arrow key nine times to highlight numeral '0' and use the scroll key twice to enter '0' 0', completing the password of 100.
6. Use the Page key to call the confirmation display.
7. If the password entry is as required, use the up arrow twice (or the down arrow once) to highlight the word 'Yes' and operate the scroll key to confirm. The top level configuration menu appears. Otherwise, 'Cancel' can be used to clear the entry in order to start again, or 'No' can be used to quit login.

3.3.8 Demand Archive

This allows a user, with a high enough access level, to archive a selected portion of the recorder history, either to a 'memory stick' plugged into the USB port at the rear of the recorder (Local Archiving), or to a pc, by means of the FTP protocol (Remote Archiving). The archived data remains in the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded.

The up and down arrow keys are used to navigate to the required field.

ARCHIVE MENU

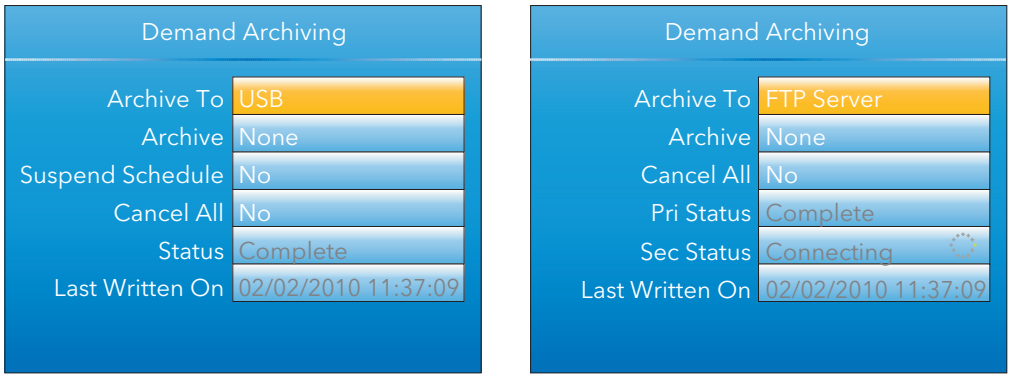


Figure 3.3.8 Demand Archive menu (Local Archiving on left; Remote Archiving on right)

Archive To	With this item highlighted, the scroll button and the up/down arrows can be used to select 'USB' or 'FTP Server'. For 'USB', the archive will be made to the rear USB memory stick. For 'FTP Server' the archive will be made to the Primary or Secondary server (configured in the Network.Archive area of configuration described in section 4.2.2.) For more details about remote archiving, see 'Remote archiving', below.
Archive	In a similar way, select the archive period: None: No archiving to take place. (Not editable when logged out) Last Hour: Archives all files created within the last 60 minutes. Last Day: Archive all files created in the last 24 hours. Last Week: Archives all files created in the past seven days. Last Month: Archives all files created in the past 31 days. Archive All: Archives all the files in the recorder's history. Bring To Date: Archives all files created or updated since the 'Last Archive' date and time.
Suspend Schedule	When set to 'Yes', automatic (scheduled) archiving is stopped, once the transfer of the current file is complete. Suspend Schedule must be set to 'No' again, to restart the suspended archive. Suspend can be used to allow the memory stick to be removed and re-fitted safely.
Cancel All	When set to 'Yes', this cancels USB archiving activity immediately, or cancels FTP archiving once transfer of the current file (if any) is complete.
Last Written on	Shows the date and time at which the last archive (demand or automatic) was performed. If a demand archive is requested, or is in operation when an automatic archive is triggered, the automatic archive takes precedence.
Status	For Archive to USB only 'Complete' means that no archiving is currently taking place. 'Transferring' indicates that an archiving is in progress. Accompanied by an animated circular display. 'Suspended' means that archiving has been suspended as requested.
PriStatus	For Archive to FTP Server only, this shows the transfer status between the instrument and the primary host computer.
SecStatus	For Archive to FTP Server only, this shows the transfer status between the instrument and the secondary host computer.

3.3.8 DEMAND ARCHIVE (Cont.)

FTP SERVER ARCHIVING

This allows the archiving of recorder files to a remote computer via the RJ45 type connector at the rear of the recorder, either directly or via a network.

In order to carry out a successful transfer:

1. Details of the remote host must be entered in the Network.Archive area of configuration (section 4.2.2).
2. The remote computer must be set up as an FTP server. Help from the user's IT department may be necessary in order to achieve this. Appendix C, Section C2 to this manual suggests one way, using Filezilla.

When accessing files using Microsoft®Internet Explorer, the address (URL) field can be in one of two formats:

1. ftp://<instrument IP address>. This allows a user to log in as the anonymous user (if the recorder has any account with the user name set to 'anonymous' with a blank password.
2. ftp://<user name>:<password>@<instrument IP address> to log in as a specific user.

For IE5 users, Microsoft® Internet Explorer displays, by default' history files only. to quit the history folder, either uncheck the Tools/Internet Options/Advanced/Browsing/'Enable folder view for FTP sites' option, or check the Tools/Internet Options/Advanced/Browsing/'Use Web based FTP' option.

3.4 DISPLAY MODES

The following subsections describe the various display modes available to the user. by default, the 'Home' display mode is 'Vertical Trend', but this can be edited as a part of 'Instrument.Display' configuration. This configuration area also allows the user to disable one or more display modes should they not be required.

The current display mode can be chosen either by using the top level menu 'Go to View' item or, from any display mode, by scrolling through the enabled modes using the up or down arrow button.

3.4.1 Vertical trend

In this mode, channel values are traced as though on a chart rolling downwards (i.e with the latest data at the top). The chart speed, and the number of major divisions are configured in the 'Group.Trend' area of configuration (section 4.3.1). By default, the chart background is black, but this can be changed to white or grey in the 'Instrument' 'Display' area of configuration (section 4.1.3).

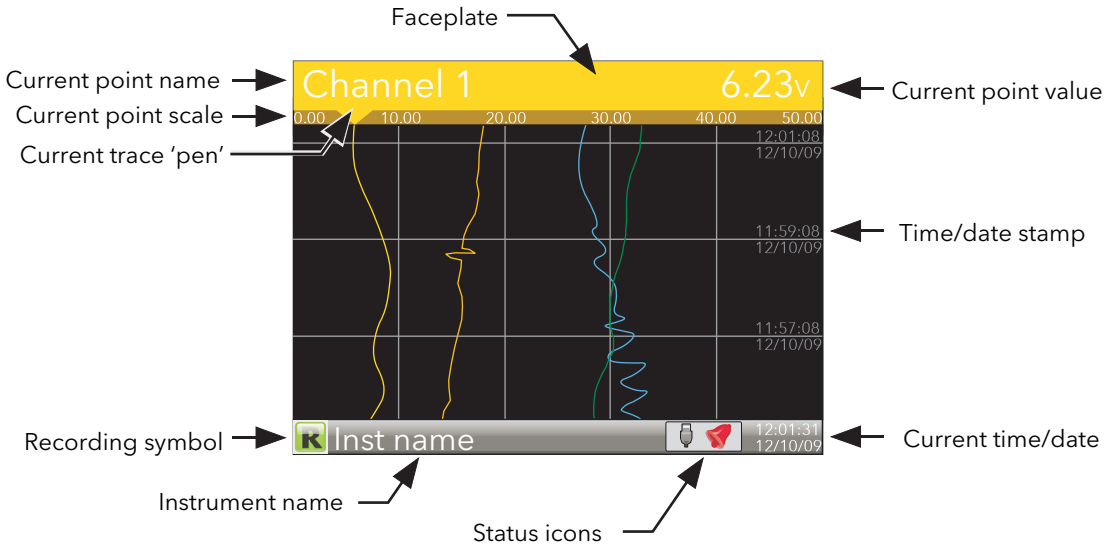


Figure 3.4 Vertical trend mode display elements

One of the channels is said to be the 'current' or 'scale' channel. This channel is identified by its pen icon being displayed, and by the channel descriptor, dynamic value and its scale being displayed on a 'faceplate' across the width of the display, above the chart.

Each channel in the Group becomes the 'current' channel in turn, for approximately five seconds -i.e. the channels are cycled through, starting with the lowest numbered channel. Once the final channel in the Group has ben displayed for five seconds, the first channel is returned-to and the process repeats. This scrolling behaviour can be enabled/disabled from the top level menu 'Faceplate Cycling (Off)' item described in section 3.3.5.

The scroll button can be used to cycle through the channels manually in both Faceplate cycle on and off modes.

Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal trend).

Use of the page key calls the top level menu.

3.4.2 Horizontal Trend mode

This view is similar to the vertical trend mode described in section 3.4.1 above, except that the traces are produced horizontally rather than vertically. Initially, as each channel appears, its scale appears at the left edge of the display (as shown below), but in order to show the maximum amount of trend data, the scale is overwritten after a few seconds.

By default, after a few seconds, the 'chart' expands leftwards to hide the scale. This feature can be disabled in the Instrument.Display area of configuration (section 4.1.3, H.Trend scaling) so that the scale is permanently on display.

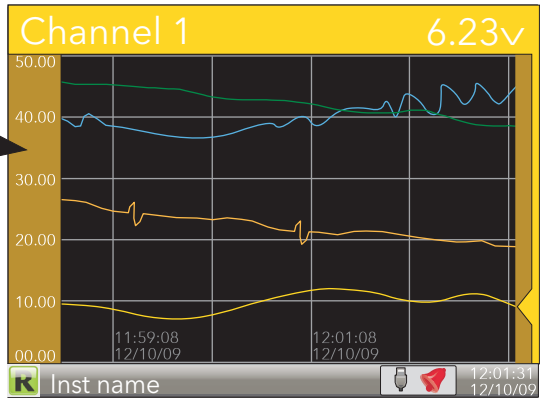


Figure 3.4.2 Horizontal trend display mode

Note: Timestamps appear to the right of the gridline to which they relate

Use of the up arrow button causes the next enabled display mode to be entered (default = vertical bargraph). Use of the page key calls the top level menu.

3.4.3 Vertical Bargraph mode

This display mode shows the channel values as a histogram. Absolute alarm threshold values appear as lines across the bars, grey if the alarm is not triggered; red if the alarm is triggered. Alarm symbols appear for active alarms.

Bargraph widths for four to six channels divide the width of the display screen equally between them. For one and two channels, the width is fixed, and the bars are centred on the screen. Figure 3.4.3 shows some examples (not to the same scale).

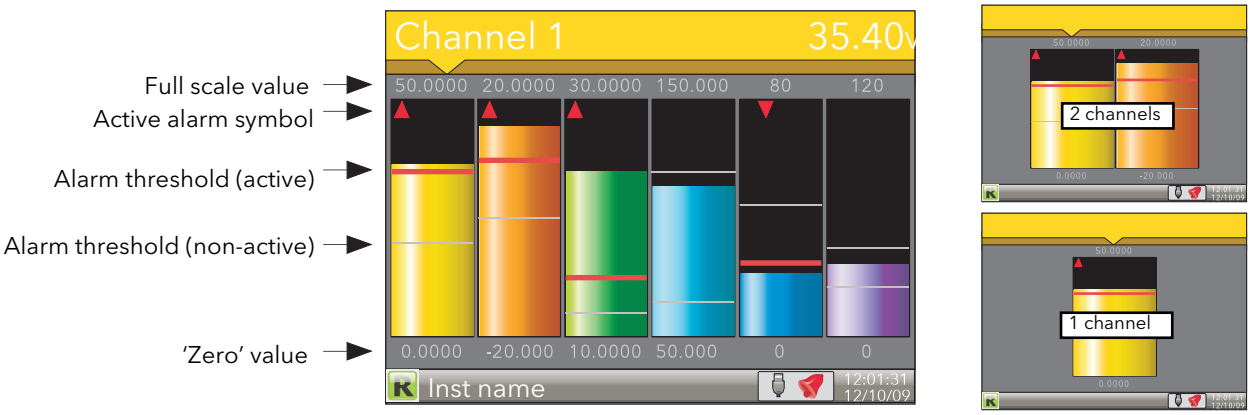


Figure 3.4.3 Vertical bargraph display mode

Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal bargraph). Use of the page key calls the top level menu.

3.4.4 Horizontal Bargraph mode

Similar to the Vertical bargraph mode described in section 3.4.3, above, but includes channel descriptors.

The scroll button toggles the text between point descriptor (as shown) and point value.

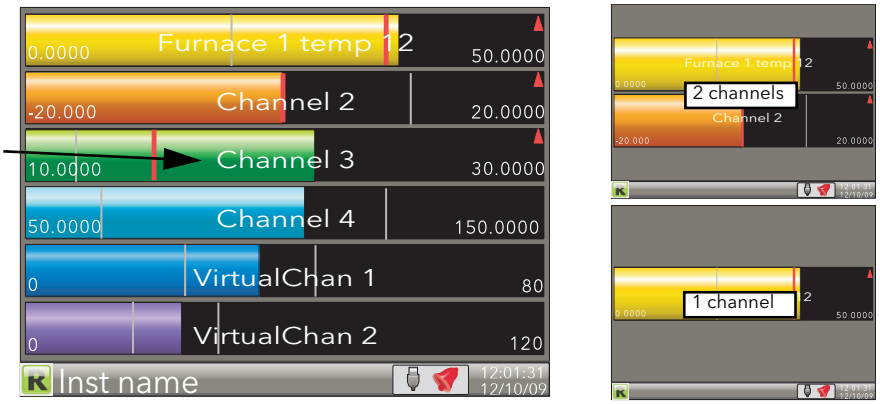


Figure 3.4.4 Horizontal bargraph mode

Use of the up arrow button causes the next enabled display mode to be entered (default = numeric).
Use of the page key calls the top level menu.

3.4.5 Numeric mode

Shows the enabled channels' values along with their descriptors and with indications of the type(s) of alarm configured for each channel.

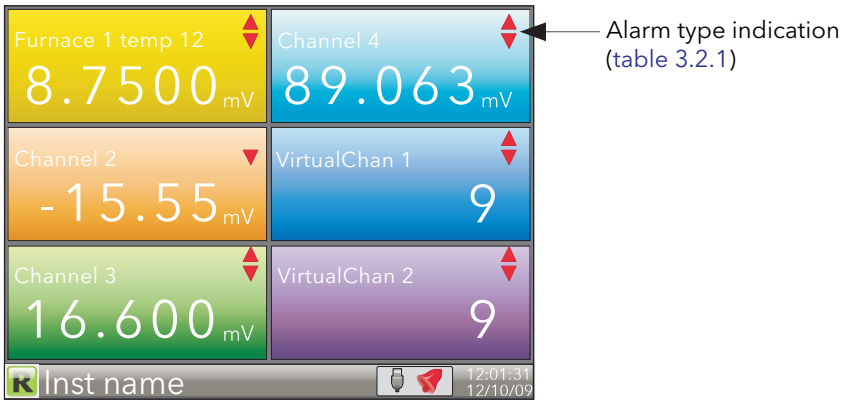


Figure 3.4.5a Numeric display mode (six enabled channels)

The figure above shows the case where there are six channels enabled in the group. The five channel layout leaves the bottom right-hand sixth of the display blank. For one to four channels, the channels occupy the width of the display, but divide the height of the screen equally amongst them as shown in the figure below.

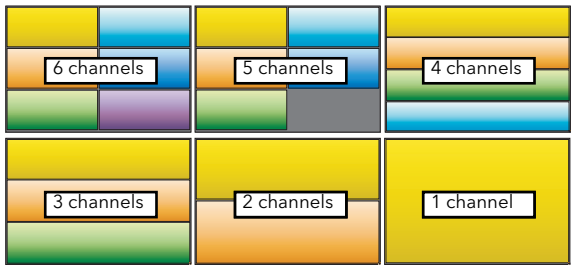


Figure 3.4.5b Display layout for different numbers of channels

The up arrow button returns to the vertical trend display mode; the page key calls the top level menu.

3.4.6 Control Loop1/Loop2

These displays appear only if the controller option is enabled (section 4.1.6).

Unlike other display modes, the loop display modes are interactive, in that the setpoint, the Auto/Manual mode and the Manual Output value can be edited from the user interface. Full configuration is carried out in the Loop setup menus (section 4.6) and a fuller description of control loops is to be found as Appendix B to this manual.

Figure 3.4.6 depicts a single loop display and the dual loop display. The up and down arrow keys are used as normal to scroll through Loop1, Loop2 and Dual loop pages.

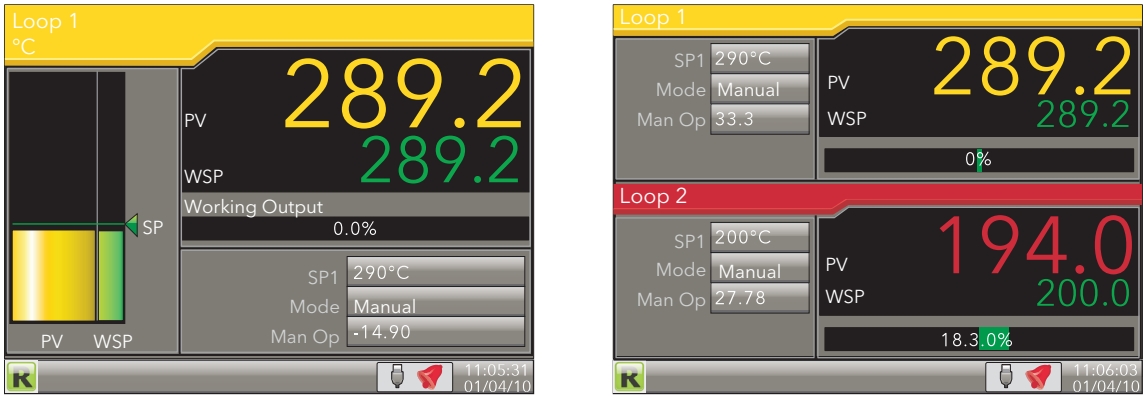
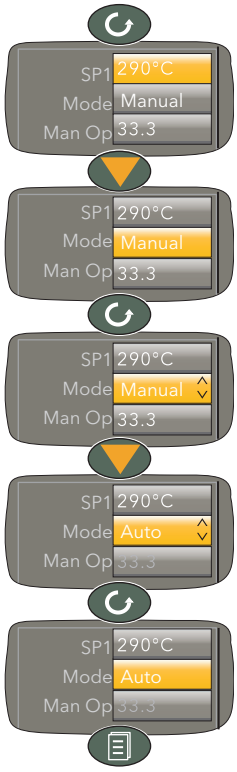


Figure 3.4.6 Loop displays

Note: The colours associated with the loops are those of the channels to which they are wired.

EDITING TECHNIQUES



1. With the loop page on display, operate the Scroll key. This highlights the first editable item (SP1). The scroll order includes both loop1 and loop 2 parameters in the dual loop display.

2. Use the up and down arrow keys to select the required field for editing. When the required field is highlighted, operate the scroll key again, to enter edit mode.

3. Use the up/down arrows to edit the current setting.

4. Operate the scroll key to confirm the edit.

5. Select a further parameter for editing, or operate the page key to return to normal operation.

Note: Edit permissions for Setpoint and Auto/Manual are set in the Loop Setup configuration menu (section 4.6.2).

3.4.7 Promote list

This display page allows the user to display up to 10 of the parameters that appear anywhere in the operator interface. The parameters can be selected only by using iTools, as described below.

Notes:

1. 'Promote List' must be enabled (in 'Instrument.Display' configuration), before it appears in the 'Go to View' list.
2. There are more parameters visible in iTools than appear at the operator interface. If non-operator interface parameters are selected for inclusion in the promote list, they do not appear.
3. If parameters which appear only in certain circumstances are selected, then they appear in the promote list only when they appear in the Operator interface. For example, a channel PV is not visible unless that channel is enabled (i.e. it is not 'Off').

PARAMETER SELECTION

1. Open iTools and scan for the instrument, (see section 6).
2. Once the instrument has been found, stop the scan. When the instrument has synchronised, click on the 'Access' button near the top of the display to set the unit into configuration mode (a password may be required).
3. Click on the '+' sign to the left of the Instrument folder in the tree list (left-most pane) to expand the folder. Double-click on 'Promote List', to display the Promote list in the main pane. The list contains 20 entries, 1 to 10 being for parameters, 11 to 20 being available to the user to add descriptors for parameters 1 to 10 respectively.
4. Expand further folders, as necessary, to access the required parameters, and click-drag these parameters into the promote list. Enter a descriptor for the parameter if the default is not as required. As each parameter is dragged into the list, it appears in the Promote list.
5. If the parameters are modified at the operator interface, the changes are reflected in iTools, and *vice-versa*.
6. Once all the parameters have been added, it is recommended that the Access button be used to quit configuration mode, as otherwise it will not subsequently be possible to quit from the operator interface.

Figure 3.4.7 shows typical displays.

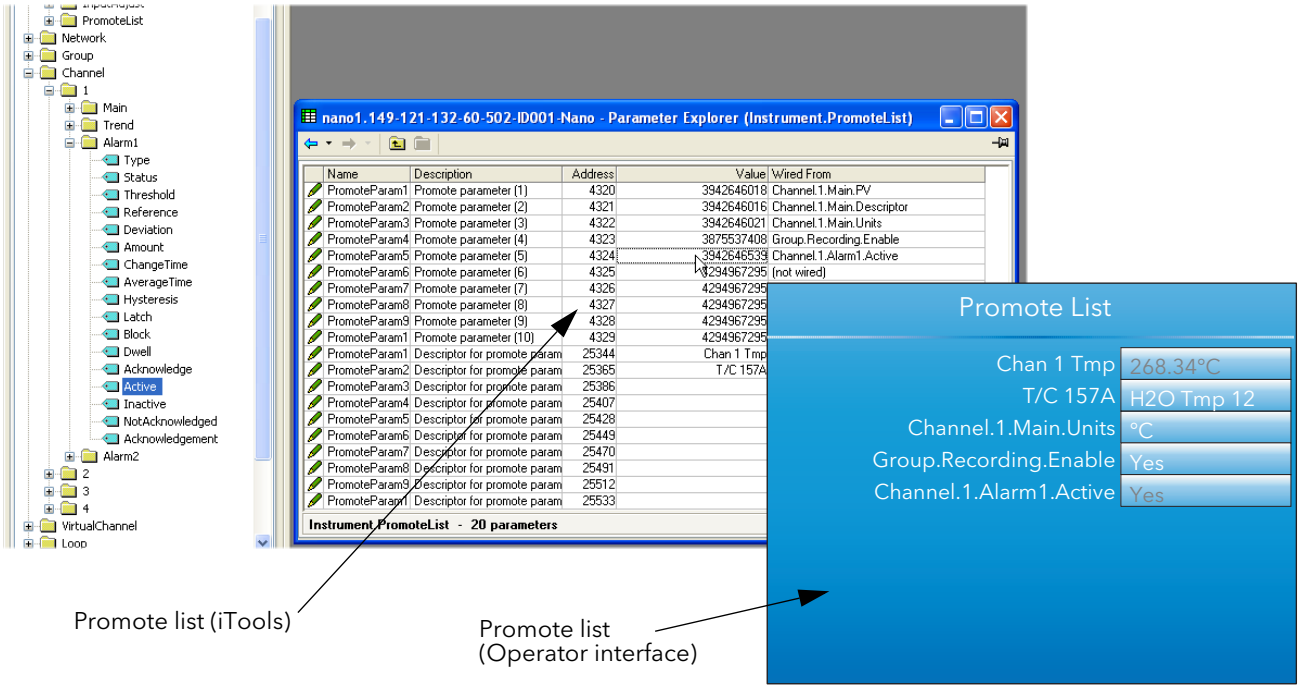


Figure 3.4.7 Promote list displays.

3.5 TREND HISTORY

Entered from the top level menu (section 3.1), this allows vertical and horizontal traces to be reviewed, one screen height/width* at a time. The amount of data displayed in one screen depends on the recording interval selected in Group Recording configuration (section 4.3.2).

The history display is identical in appearance with the trend display except:

1. History displays can include alarm and operator messages if so desired.
2. For horizontal trends, the scale is displayed permanently at the left edge of the display.

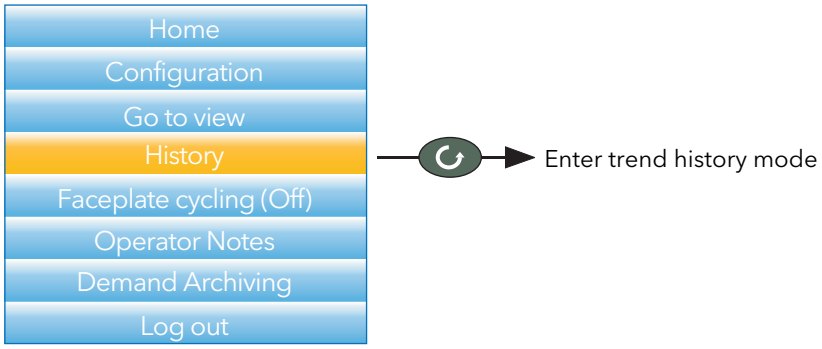


Figure 3.5a Top level menu

3.5.1 Navigation

The down arrow button moves the display backwards in time by one screen height* per operation (assuming that the current display is not the earliest).

The up arrow button moves the display forwards in time by one screen height* per operation (assuming that the current display is not the latest).

The scroll key scrolls through the group channels displaying each channel's value at the time represented by the top edge of the screen (right hand edge for horizontal trends).

The page key calls the history options menu, described below.

* The options menu, described below, offers a number of alternative choices for defining how much the history jumps for one button press.

3.5.2 Options menu

Operating the page key from any history display, causes the history options menu to appear. For this menu, the scroll button is used to scroll to the required selection, and the page button to return to the history display.

Note: When quitting history mode, the scroll key causes a return to the level one menu, where a further selection must be made, and confirmed by scroll key action. Operation of the page key, before this selection returns the user to the history display.

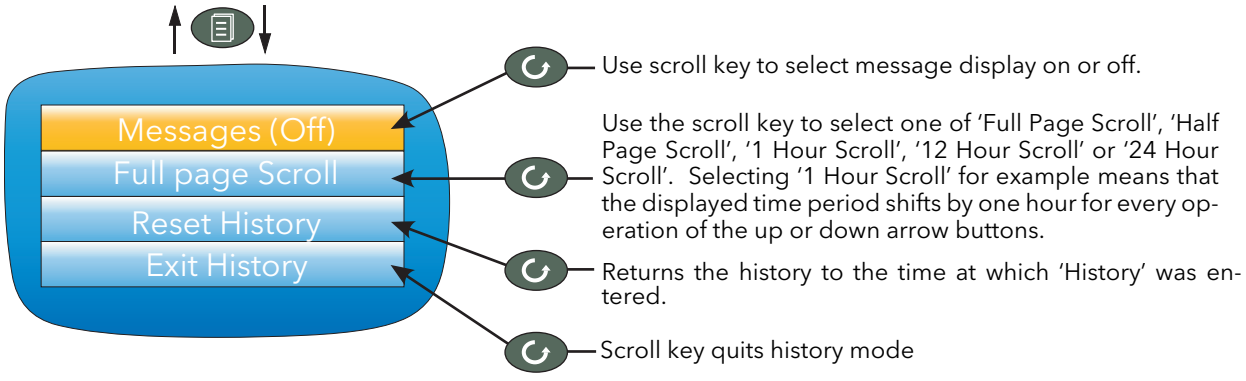

Messages (Off)
Full page Scroll
Reset History
Exit History
Use scroll key to select message display on or off.
Use the scroll key to select one of 'Full Page Scroll', 'Half Page Scroll', '1 Hour Scroll', '12 Hour Scroll' or '24 Hour Scroll'. Selecting '1 Hour Scroll' for example means that the displayed time period shifts by one hour for every operation of the up or down arrow buttons.
Returns the history to the time at which 'History' was entered.
Scroll key quits history mode

Figure 3.5.2 Options menu

3.6 TEXT ENTRY

The user is often required to enter text characters or numbers (when editing operator notes, for example). This is done using the pop-up keyboards which are displayed when required. When only numerals are required a special keyboard is presented which contains only numerals.

Figure 3.6 shows the three standard keyboards, along with a 'scan' direction for operations of both up arrow and down arrow keys. To change keyboards, use the arrow pushbuttons to highlight the keyboard name ('Numeric', 'Symbols' or 'Alpha'), and then operate the scroll button.

Generally, to enter text, the required character is highlighted using the up and down arrows and the scroll button is used as an 'Enter' key. Once text entry is complete, the Page button is used to confirm the edit (use the down arrow to select 'Yes' then operate the scroll button).

Pressing and holding the scroll button and then immediately operating the up or down arrow, causes the character insertion point to move to the left (down arrow) or to the right (up arrow).

The user can press and hold the scroll key to display variations on certain characters (the letter 'e' in the figure). Once displayed, the up and down arrows can again be used to scroll through auxiliary list, allowing capital letters, and characters with diacriticals (e.g. accents, umlauts, tildes, cedillas) to be selected and entered using the scroll button.

The backarrow key is used as a back space key - i.e. it deletes the character to the left of the cursor position. The 'Del' key deletes the character to the right of the cursor.

Note: Leading and trailing space characters are automatically removed from text strings.

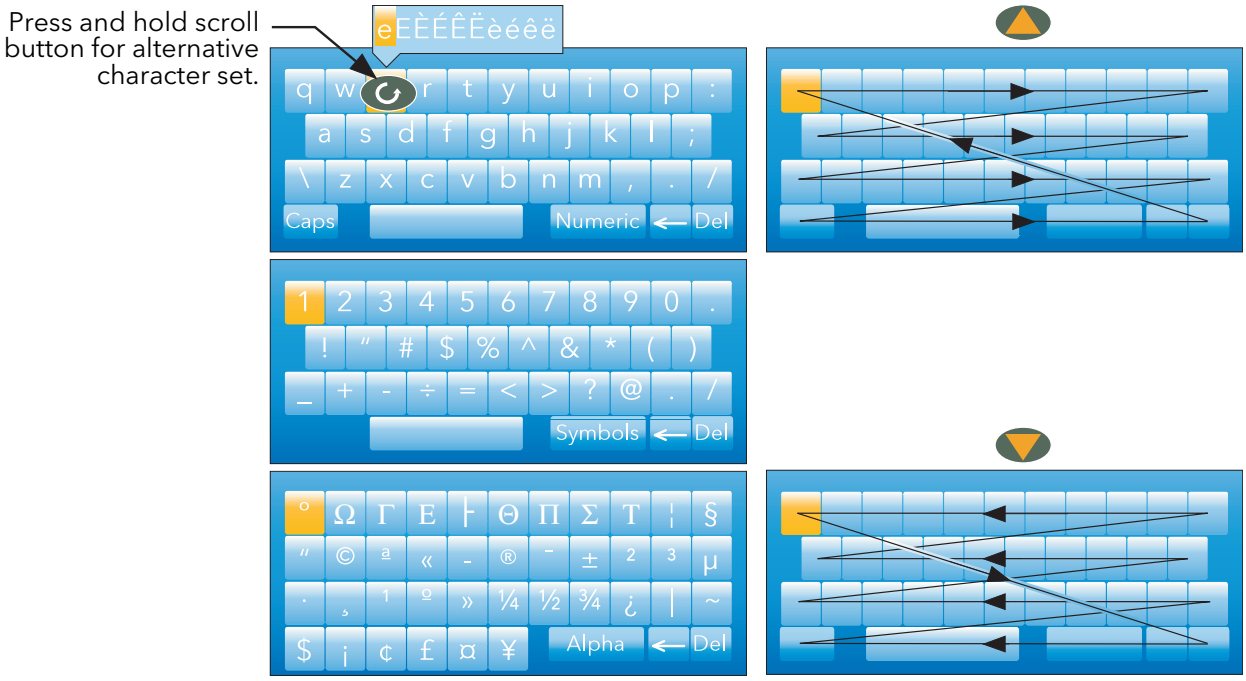


Figure 3.6 Standard Keyboards

3.6.1 Numeric keyboard

As mentioned previously, for functions which can take only numerals, a special numeric keyboard appears, as depicted in figure 3.6.1.

Figure 3.6.1 Numeric keyboard

4 CONFIGURATION

Entered from the top level menu (section 3.1) this allows the recorder configuration to be accessed and edited ('Engineer' access level required for full editing).

CAUTION

Recording is stopped for as long as the recorder login is at Engineer level. This means that Input/output circuits are switched off during configuration.

As shown in figure 4, below, the recorder configuration is arranged in a number of 'areas', each of which is allocated its own sub-section within section 4.

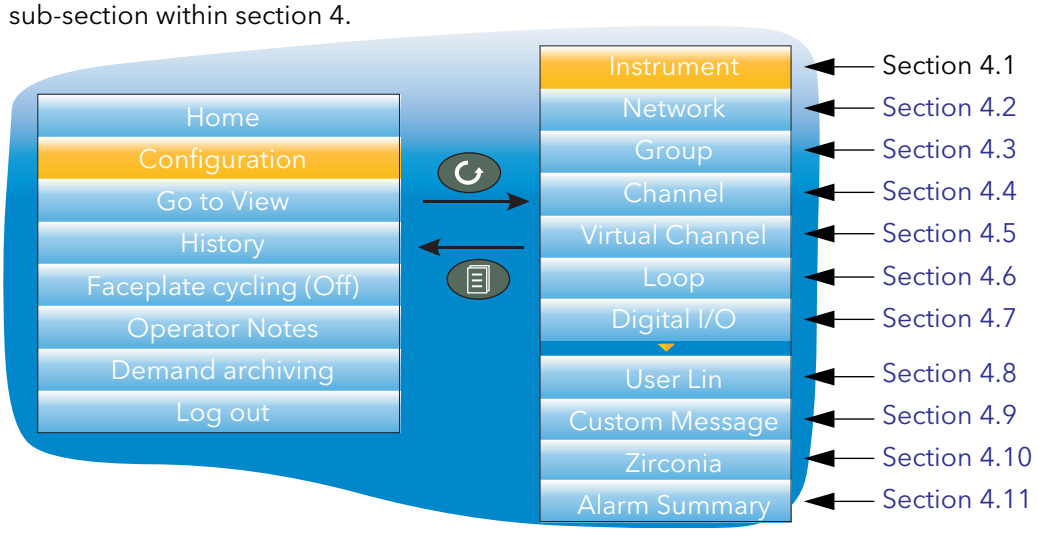
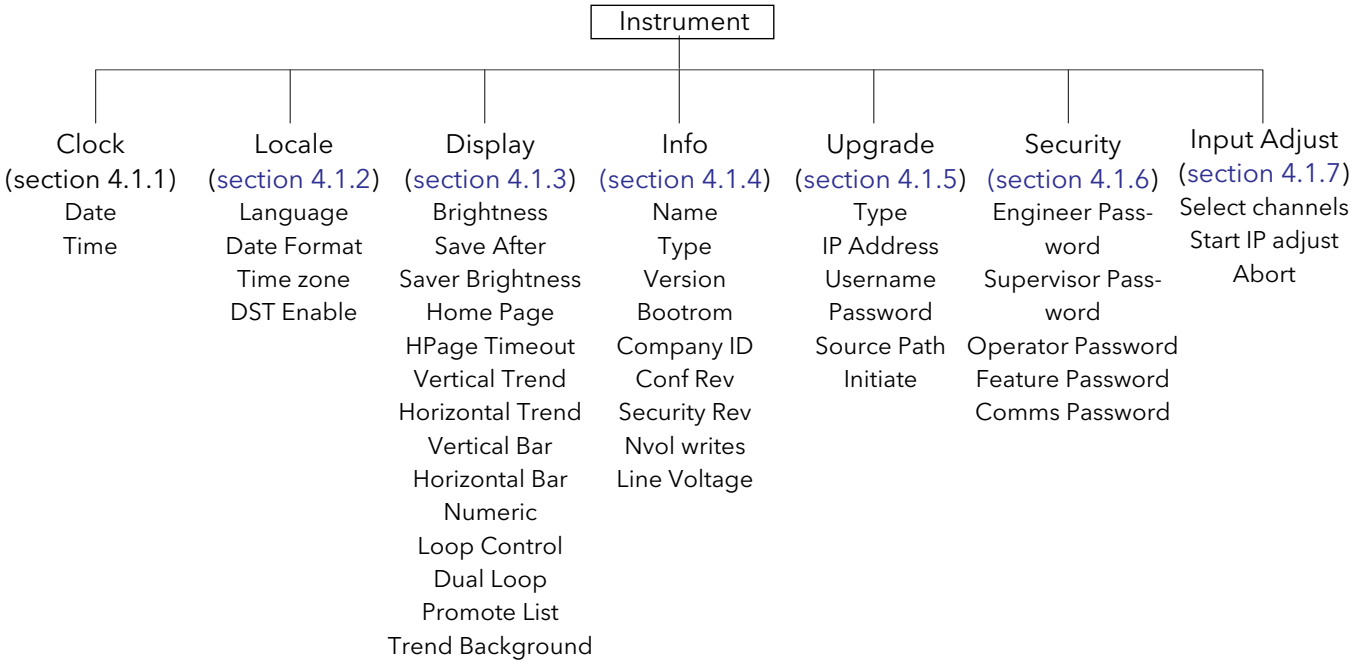


Figure 4 Top level configuration menu

The factory default configuration can be returned-to, if required, by entering a special Engineer password, as described in section 4.1.6.

4.1 INSTRUMENT MENU



4.1.1 Clock

The up and down arrows are used to highlight 'Date' (default) or 'Time'.

To set the date, the scroll button is used to display the numeric keyboard described in section 3.6.1. The up and down arrows are used to highlight the relevant numeral or separator ('/' or ':') and the scroll key used to enter it into the display window.

To set the time, the scroll button is operated to enter edit mode, then the up and down buttons are used to scroll to display a time, say 15 seconds later than the current time. Once the current time matches the display, the scroll button is pressed to confirm the time and to start the clock.

The 'DST' field appears only If 'DST Enable' is selected 'Yes', in 'Locale' (section 4.1.2). If the 'box' contains a cross (as shown) then Daylight Saving Tme (DST) is not currently active. A 'tick' means that the time shown has been advanced by an hour because DST is active.

4.1.2 Locale

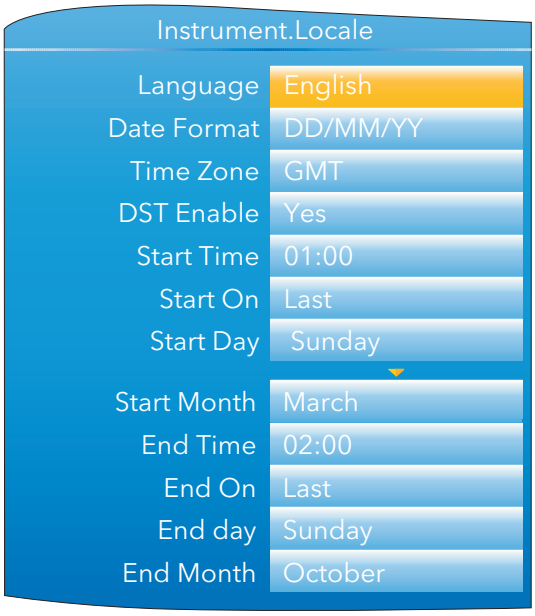


Figure 4.1.2 Typical Instrument configuration menu (expanded to show all fields)

Language	English is the only language available at this software release.
Date format	With the DD/MM/YY field highlighted (default), use the scroll button to open the selection for edit, then use the up and down arrows to scroll through the available date formats: MM/DD/YY, YY/MM/DD. When the required format is displayed, operate the Scroll button to select it and at the same time to quit edit mode.
Time Zone	Select the required offset from GMT (UTC). This setting affects only the displayed time. Archiving, recording etc. times remain in GMT.
DST Enable	Daylight Saving Time enable. Once the selection is enabled, the following (previously hidden) fields appear, allowing the start and end dates for Daylight Saving Time (DST) to be configured. DST affects only the displayed time. Archiving, recording etc. times remain in GMT.
Start Time	Appears only when 'DST Enable' (above) is set to 'Yes'
Start On	With this field highlighted, the scroll button is used to enter edit mode, which allows the user to use the up and down arrows to scroll through the following: 'Last', 'First', 'Second', 'Third' or 'Fourth'. Once the required week is displayed, operate the Scroll button to select it and at the same time to quit edit mode. Used in conjunction with the 'Start Day' and 'Start Month' entries following.
Start Day	Use the normal selection and scroll techniques to select the day of the week on which DST is to commence.
Start Month	Use the normal selection and scroll techniques to select the month in which DST is to commence.
End Time, End On, End Day, End Month	As for 'Start Time' etc. above, but specifies the end time and date for daylight savings.

4.1.3 Display configuration

This allows the user to set display brightnesses and screen saver details, to select a display mode as the 'Home' page, and to enable/ disable the various display modes. The normal 'Select, Scroll, Enter' editing technique is used as has been previously described.

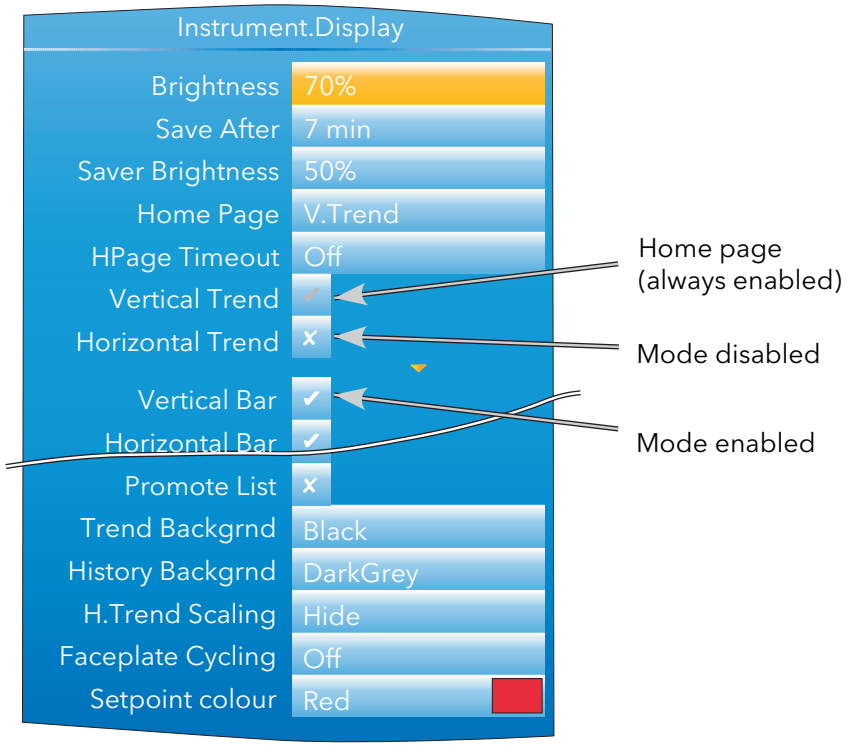


Figure 4.1.3 Display menu (expanded to show all fields)

Brightness	Allows the user to select a normal operating brightness for the screen from 10% to 100%, in 10% steps.
Save After	The elapsed time (since last button press) before the screen switches from 'Brightness' to 'Saver Brightness'. (Off = saver function disabled)
Saver Brightness	The screen saver brightness. Valid entries are 10% to 100% inclusive, in 10% steps. Using a lower power when not 'in use' not only saves power, but also increases display life. Typical screen power consumption is 0.5W at 100%, falling in a linear fashion to 0.05W at 10%.
Home page	Allows any display mode to be chosen as the 'Home' page. This is the page that the recorder displays at power up, and also the page displayed when the 'Home' key is selected from the top level menu (section 3.3). The selected display mode (vertical trend in figure 4.1.3) is always enabled in the following display mode enable fields (its 'tick' is greyed out and cannot be edited). See section 3.4 for a description of the available modes.
HPage Timeout	The elapsed time (since last button press) before the display returns to the home screen. (Off = disabled)
Vertical Trend	This is the default home page, and its tick is greyed. If this is not the home page, the tick can be changed to a cross, by highlighting it and operating the scroll button.
Horizontal Trend, Vertical Bar, Horizontal bar, Numeric, Control Loop 1/2*, Promote List.	As for Vertical Trend, above, but by default all the enable ticks/crosses are white and are thus editable. If any of these display modes has been selected as the home page then the tick associated with that mode is non editable and is greyed.

*Note: Control loop pages appear only if the Loop option is fitted.

4.1.3 DISPLAY CONFIGURATION (Cont.)

Trend Background	Allows the user to select black (default), white dark grey or light gray as the 'chart' colour.
History Background	As above for 'Trend background', but for history displays.
H.Trend Scaling	As described in section 3.4.2, by default, the scale for horizontal trends appears at the left edge of the chart for a few seconds before the chart expands leftwards to occupy the scale area. Setting 'H.Trend Scaling' to 'Permanent', ensures that the scale remains permanently on display.
Faceplate cycling	Allows the default faceplate cycling state to be defined as 'On' or 'Off' (section 3.3.5)
Setpoint colour	The colour for the setpoint in Control Loop display pages (section 3.4.6).

4.1.4 Info menu

Gives information about the recorder hardware and software, and allows the user to enter a descriptor for the instrument. The normal 'Select, Scroll, Enter' editing technique, previously described) is used to edit those fields that are not read only.

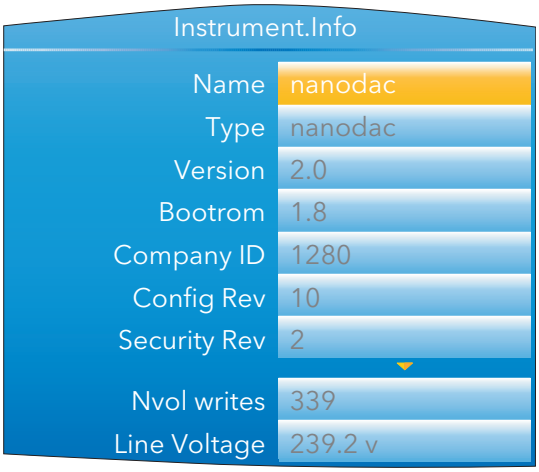


Figure 4.1.4 Info menu (expanded to show all fields)

Name	Allows the user to enter a descriptor of up to 20 characters, using the text entry techniques described in section 3.6. The number of characters visible in the display mode pages varies according to the number of alarm symbols on display.
Type	Nano. Read only display of the instrument model (used by 'iTools').
Version	Read only. The software version of the instrument.
Bootrom	Read only. Instrument software Boot ROM version
Company ID	Read only. For CNOMO* purposes over Modbus (1280 decimal; 0500 hex).
Config Rev	Read only. This value is updated, and a message including this value generated, every time configuration is quit, if any one or more configuration parameter has been changed.
Security Rev	Read only. This number is incremented every time configuration is quit, if any one or more passwords has been changed, or if the FTP Server username has been changed, or if the Comms Enable field has been edited.
Nvol writes	Number of non volatile write operations for diagnostic purposes.
Line voltage	The instantaneous value of the supply voltage applied to the instrument. Used in some control loop operations.

* CNOMO = Comité de normalisation des moyens de production.

4.1.5 Upgrade

CAUTION

Power must not be removed from the unit whilst upgrade is in progress, as to do so will cause permanent damage the unit.

This item allows the user to update the instrument firmware, either from a memory stick in the USB socket at the rear of the unit, or via FTP transfer from a host computer. The upgrade file is downloaded from the recorder manufacturer and is transferred to the instrument by memory stick or by FTP transfer.

The unit restarts automatically, after an upgrade.

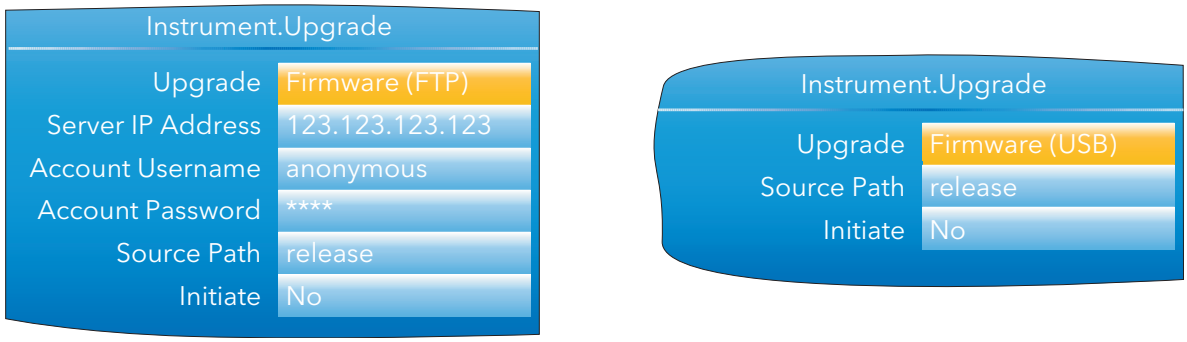


Figure 4.1.5 Typical Upgrade menus

Upgrade	Select 'Firmware (USB)', 'Firmware (FTP)' or 'Bootrom (USB)' as the source of the upgrade.

CAUTION

'Bootrom' is for factory use only, and its unauthorized use can permanently damage the recorder.

Server IP Address	For 'Upgrade' = 'Firmware (FTP)' only, this field must contain the IP address of the pc which is to supply the upgrade file.
Account Username	For 'Type' = 'Firmware (FTP)' only, the username set up in the host ftp server
Account Password	For 'Type' = 'Firmware (FTP)' only, the password set up in the host ftp server
Source Path	The name of the directory from which the upgrade file is to be read. This is only the name of the directory without any path elements (e.g. '/') included unless the path is 'release/upgrade/files'.
Initiate	Select 'Yes' to initiate the upgrade.

4.1.6 Security menu

This allows the user to enter passwords for all security levels (except logged out), and to enable/disable serial communications security.

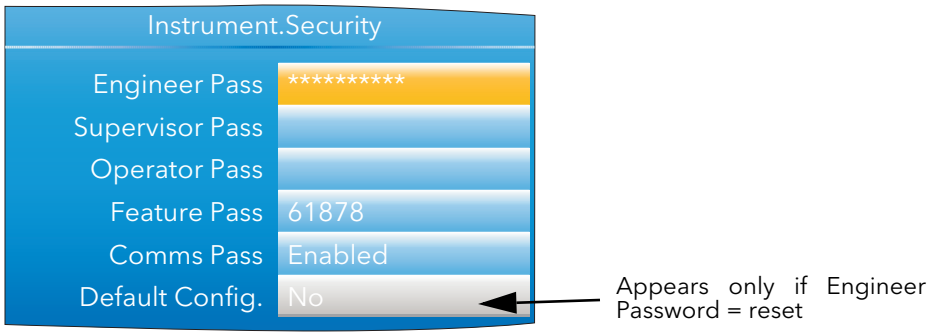


Figure 4.1.6 Security menu

Engineer Pass	Gives access to configuration menus. Set to 100 when despatched, but can be edited here, if required, by entering an alternative of up to 20 characters (note 1). If 'reset' (case sensitive) is entered as the Engineer Password, the 'Default Config.' field appears allowing the instrument default configuration to be restored (note 2).
Supervisor Pass	A password (none by default) of up to 20 characters can be entered here to protect Supervisor level access.
Operator Pass	A password (none by default) of up to 20 characters can be entered here to protect Operator level access.
Feature Pass	This is a password supplied by the manufacturer to enable the software options (e.g. Loop, Zirconia block etc.). When applying for this code, the manufacturer will require the MAC address (Network.Interface menu section 4.2.1) and the instrument's firmware Version (Instrument.info menu - section 4.1.4). The password is MAC address and time dependent so that it cannot be used on any other instrument.
Comms Pass	Enables/disables password security for external communications. If set to 'Enabled', the Engineer level password will be required if an attempt is made to enter the configuration menus from a remote pc. If set to 'Disabled', then access to configuration can be gained over a communications link, without a password. If enabled, then entry to configuration mode via the Instrument Mode (IM) parameter must be completed within 5 seconds of entering the password, or the attempt will fail.
Default Config	This field appears only if 'reset' has been entered as the Engineer Password. Selecting 'Yes' Causes the instrument to restart with default configuration (i.e. the instrument 'cold starts'). See note 2.

Notes:

1. It is recommended that only such characters as appear on the user's pc keyboard be used in the Engineer password. The use of other characters makes it necessary to use 'Escape' codes (e.g. Alt 0247 for the '÷' sign) when trying to enter configuration mode from iTools, for example.
2. Restoring factory default configuration can also be carried out in iTools, using the Engineer password 'reset' and selecting Default Config to 'Yes'.

4.1.7 Input adjust

Notes

1. Input adjust cannot be applied to input channels with input type of 'Digital', 'Test' or 'Off'.
2. Input adjustments can be carried out only by users logged in as 'Engineer' (see section 3.3.7).
3. The instrument must be powered for a sufficient time (e.g. 30 minutes) for it to reach thermal equilibrium before an input adjust is performed.

This facility allows the user to compensate for tolerance errors etc. The technique used is to select those channels to which adjust is to be applied, then for each channel to:

a apply a known low level signal (at or close to the low input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

b. apply a known high level signal (at, or close to, the high input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

Figure 4.1.7a shows a typical display when 'Input adjust' is selected from the Instrument menu, and Apply adjust has been selected. As can be seen, channel 3 has previously been adjusted.

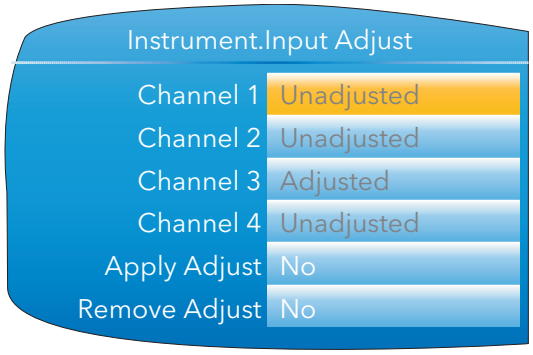


Figure 4.1.7a Input adjust top level display

Channel 1 to 4	Shows the adjust status of each channel
Apply Adjust	Selecting 'Yes' initiates the adjustment procedure described below.
Remove Adjust	Selecting 'Yes' initiates the adjustment removal procedure described below.
Abort	Allows the user to abandon input adjustment at any point in the procedure.

ADJUSTMENT PROCEDURE

1. As shown in figure 4.1.7b, highlight the 'Apply Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select 'Yes'. Use the scroll button to change Channel 1 'cross' to a 'tick' (check mark). Similarly select any other channels which require adjustment.

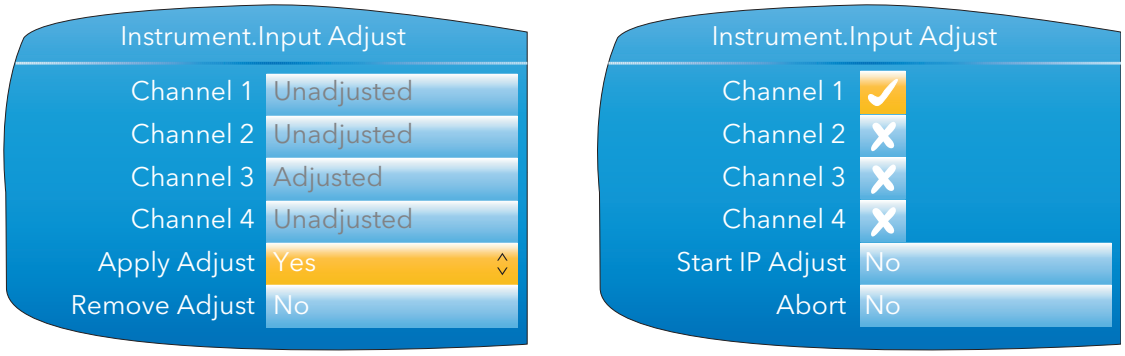


Figure 4.1.7b Channel adjustment procedure (1)

4.1.7 INPUT ADJUST (Cont.)

ADJUSTMENT PROCEDURE (Cont.)

2. Highlight the 'Start IP 'Adjust' field and use the scroll and up/down arrow to select 'Yes'. Use the scroll key again to enter the low value adjust page.
3. Apply the known low value and wait for the value to stabilise. Enter the 'Low Target Value' (the value that the recorder is to read for the applied input). When all is steady, use the scroll and up/down arrow to set the 'Confirm Low' field to 'Yes', then operate the scroll button again.

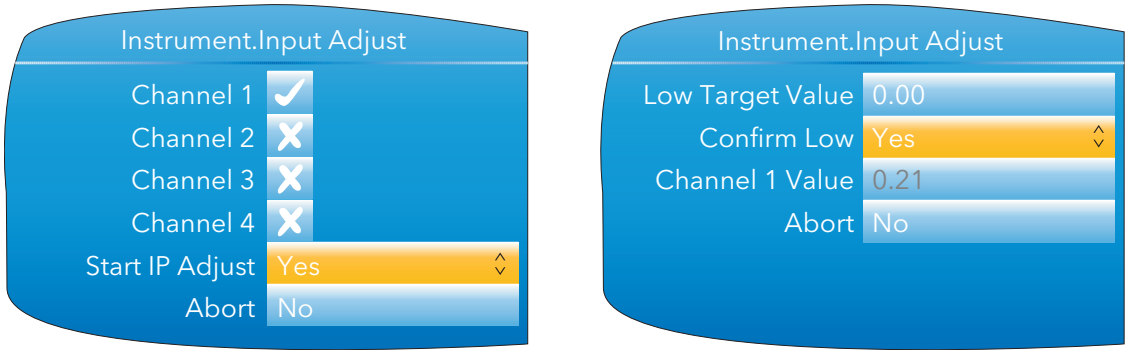


Figure 4.1.7c Channel adjustment procedure (2)

4. The display changes to the high value adjust page.
5. Apply the known high value and wait for the value to stabilise. Enter the High Target Value (the value that the recorder is to read for the applied input). When all is steady, set 'Confirm High' to 'Yes'.

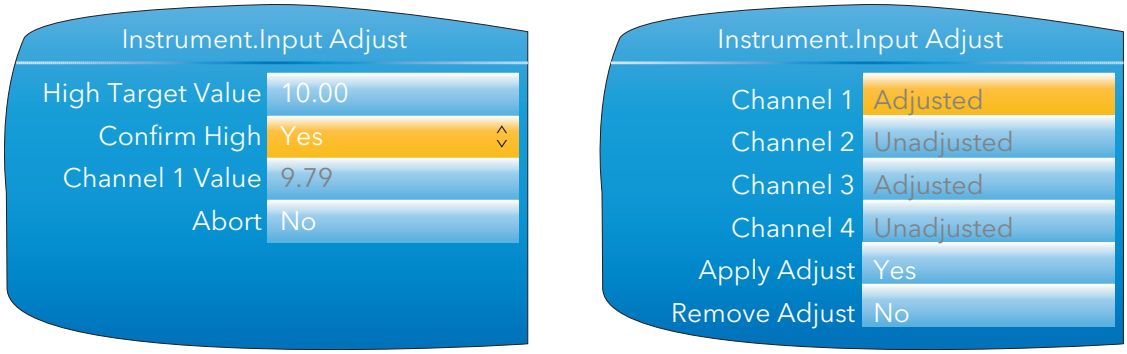


Figure 4.1.7d Channel adjustment procedure (3)

REMOVAL PROCEDURE

1. Set 'Remove Adjust' to 'Yes' and operate the scroll button.
2. Use the scroll and up/down arrow buttons to change the required channel icons from crosses to ticks.
3. Select Remove IP Adjust to 'Yes' and operate the scroll key. The adjustment is removed from all selected channels without further confirmation.

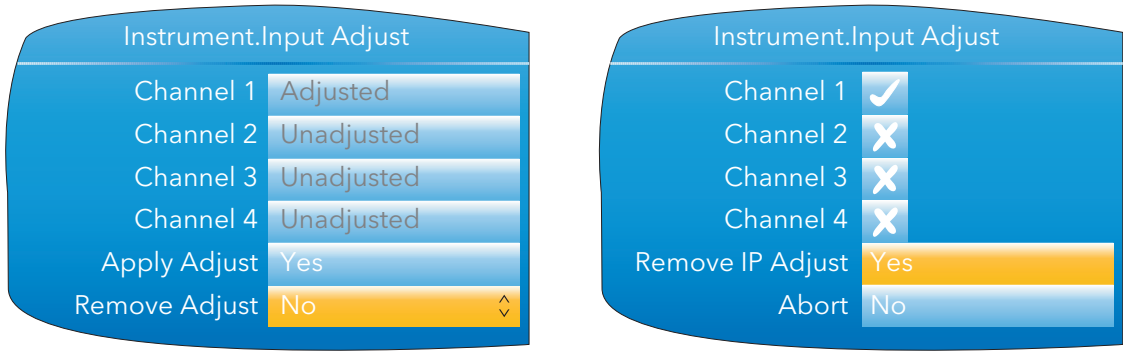
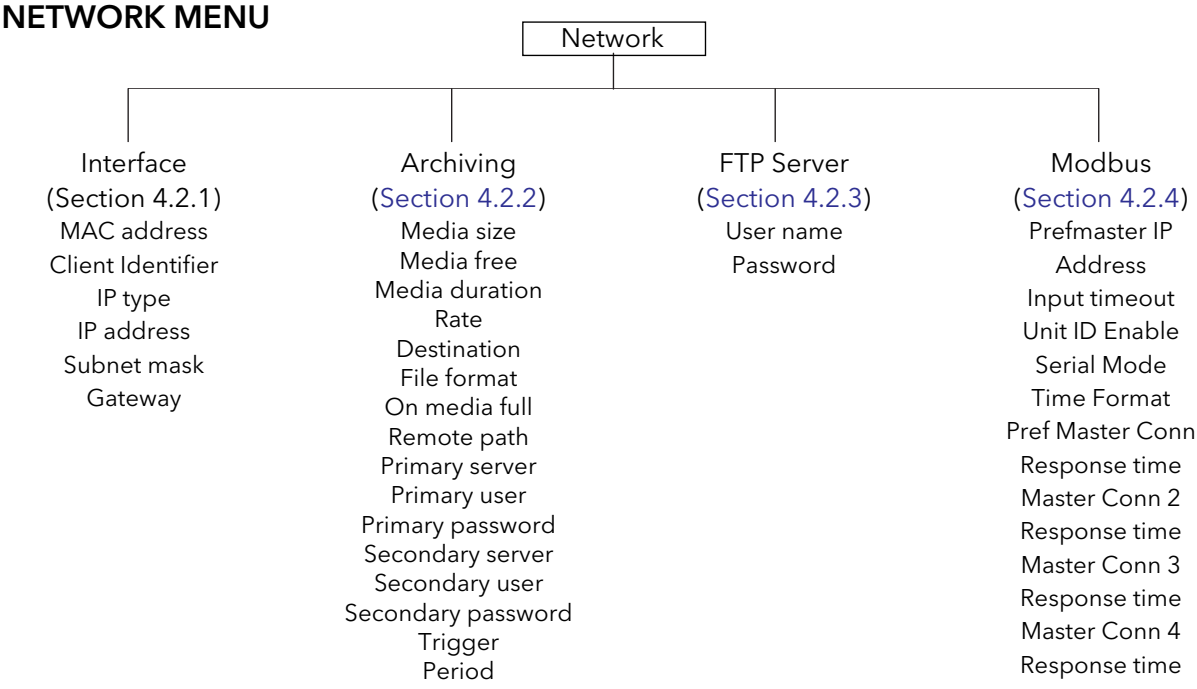


Figure 7.1.7e Channel adjustment removal

4.2 NETWORK MENU



4.2.1 Interface

This area of configuration allows the user to set up an IP address for the instrument, either by typing one in (Fixed), or automatically (DHCP), assuming a DHCP server is running.

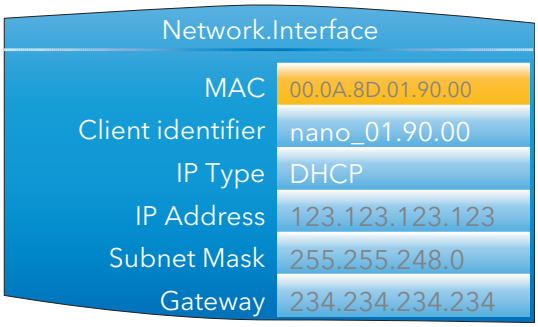


Figure 4.2.1 Network Interface menu

MAC	Read only. Media Access Control. A unique address for each instrument, entered at the factory.
Client Identifier	The client identifier is a unique id used by DHCP servers that implement option 61. Each nano product will have a unique ID built up from their MAC address. If the DHCP server is configured to use option 61, then it will use this id instead of the MAC address to assign a dynamic IP address.
IP Type	If 'Fixed', the user needs to enter an IP address and Subnet Mask in the following fields, and a Gateway address if required. If 'DHCP' the subsequent fields become read only, with the entries automatically generated by the DHCP server. When set to DHCP, it takes several seconds before the IP address is obtained from the DHCP server.
IP Address	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', the user may enter an IP address (IPV4 dot notation). This would normally be supplied by the user's IT department, or from the Network supervisor.
Subnet Mask	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', this sets a range of IP addresses that can be accessed. Normally supplied by the user's IT department, or from the Network supervisor.

4.2.1 INTERFACE (Cont.)

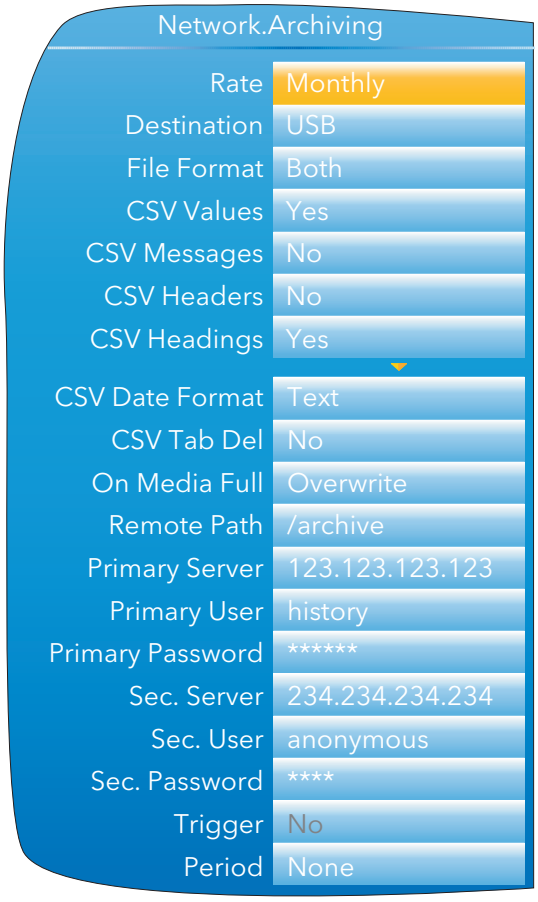
Gateway — Read only if 'IP Type' = 'DHCP'.
If 'IP Type' = 'Fixed' this allows the user to enter a gateway address for use when the unit is to communicate outside the local network. Normally supplied by the user's IT department, or from the Network supervisor.

4.2.2 Archiving

This area of configuration is used to set up the parameters for use during unattended archiving. Some of the fields appear only if other fields are set to a particular value. For example, the CSV fields appear only if 'File Format' is set to 'CSV' or to 'Both'.

The archived data is not removed from the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded.

Remote with Binary file format



Local with CSV files included

Figure 4.2.2a Unattended Archive configuration (typical settings)

Media Size — Appears only for File Format = 'Binary (UHH)'. A read only value showing the capacity of the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.

Media Free — Appears only for File Format = 'Binary (UHH)'. A read only value showing the space remaining in the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.

Media Duration — Appears only for File Format = 'Binary (UHH)'. A read only value showing the time it will take to fill the Memory stick if the recorder configuration remains unchanged.

4.2.2 ARCHIVING (Cont.)

Rate — Allows the user to specify the frequency at which the contents of the Flash memory are archived to the USB port or, via FTP, to a pc. Scrollable settings are:

- **None** — Automatic archiving is disabled. Any archiving must be initiated by the user using Demand Archiving, as described in section 3.3.8.
- **Hourly** — Archive occurs on the hour, every hour.
- **Daily** — Archive initiated at 00:00* each day
- **Weekly** — Archive is initiated at midnight* every Sunday
- **Monthly** — Archive is initiated at 00:00* on the 1st of every month.
- **Automatic** — The recorder selects the least frequent of the above archive periods which is guaranteed not to lose data as a result of the internal flash memory's running out of space.

*Note: Archive times are not adjusted for daylight saving time (DST). Thus, if the archive is set to 'Daily', 'Weekly' or 'Monthly', then during summer time, the archive will be triggered an hour late (i.e at 01:00 hours instead of midnight).

Destination — Select 'FTP Server' for archive to a remote pc, or 'USB' to archive to the USB port device.

File format — Select 'Binary (UHH)' 'CSV' or 'Both'.

- **Binary (UHH)** — A proprietary format used by the instrument that needs other software (e.g. Review', to interpret the data before it can be presented in spreadsheets etc. Binary files have the extension '.uhh'.
- **CSV** — This format is a standard open-file format for numeric data. A simple ASCII-based format, it is readable by a wide range of pc applications as well as being suitable for direct import into many commercial databases. CSV files have the extension '.csv'.
- **Both** — Archiving includes both .uhh and .csv files.

Note: CSV is ASCII based and cannot interpret Unicode characters. For this reason, some characters available to the user will not be displayed correctly in .csv files.

CSV Values — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then process values are included in the file (see figure 4.2.2b for details).

CSV Messages — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then messages are included in the file (see figure 4.2.2b for details).

CSV Headers — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then Header details are included in the file (see figure 4.2.2b for details).

CSV Headings — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then column headers are included in the file (see figure 4.2.2b for details).

CSV Date Format — Appears only if 'File Format' is set to 'CSV' or 'Both'. Allows 'Text' or 'Spreadsheet ' to be selected. Text causes a time/date to appear in the spreadsheet. 'Spreadsheet Nu' displays the number of days since December 30th 1899. The decimal part of the number represents the latest six hours. For example: DDD--- --DD.25 represents 06:00 hours and DDD--- --DD.5 represents 12:00 hours. Spreadsheet Numeric format is more easily interpreted than 'Text' by some spreadsheet applications.

CSV Tab Del — Appears only if 'File Format' is set to 'CSV' or 'Both'.
CSV (Comma Separated Variables) does not always use commas as separators. For example, in some countries the decimal point is represented by a full stop (period), whilst in others a comma is used. In order to avoid confusion between a comma as a decimal point and a comma as a separator, a different separator can be used. This field allows the 'tab' character (^t) to be used instead of a comma.

4.2.2 ARCHIVING (Cont.)

On Media Full — For 'Destination' = 'USB' only, this allows the user to select 'Overwrite' or 'Stop' as the action to be taken when the memory stick is full. 'Overwrite' causes the oldest data to be discarded from the memory stick to make room for newer data. 'Stop' inhibits archiving activity.

Remote Path — Left blank if the archive destination is the home folder. If the destination is to a subfolder within the home folder, then the name of the subfolder is entered here, preceded by a '/' character (e.g. '/history').

Primary Server — Allows the user to enter the IP address for the pc to be used as the primary FTP server.

Primary User/Password — These are the Login name and password of the remote host account, assigned either by the Network administrator, or set up in the 'Guest' account of the remote host's 'FTP server' or 'User Manager' configuration.

Sec. Server/user/password — As Primary server details above, but for the secondary FTP server used when the primary is not available for any reason.

Trigger — This parameter can be 'wired' to, say, an alarm going active, or a digital input, to allow an archive to be triggered remotely. Can also be set to 'yes' manually.

Period — Appears only if 'Trigger' is wired (section 7). Allows a period of history to be selected for archiving when 'Trigger' goes 'true. Selections are: None, Last Hour, Last Day, Last Week, Last Month, All, Bring to Date. ('Last Month' archives the last 31 days of history.)

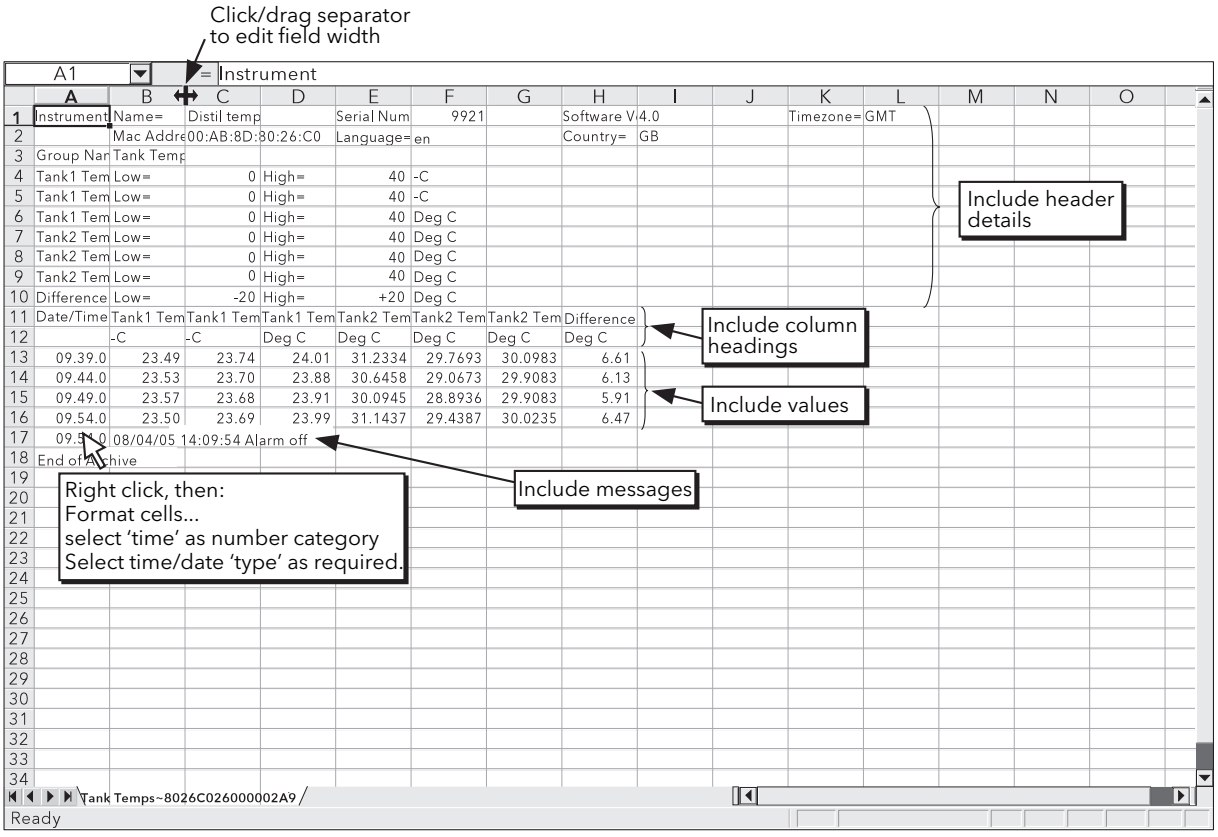


Figure 4.2.2 CSV data example

4.2.3 FTP Server

This area of configuration allows the user to enter the Username and Password used to access the instrument from a remote FTP client.

4.2.4 Modbus TCP

This allows the user to configure the recorder so as to allow it to communicate using Modbus Transmission Control Protocol.

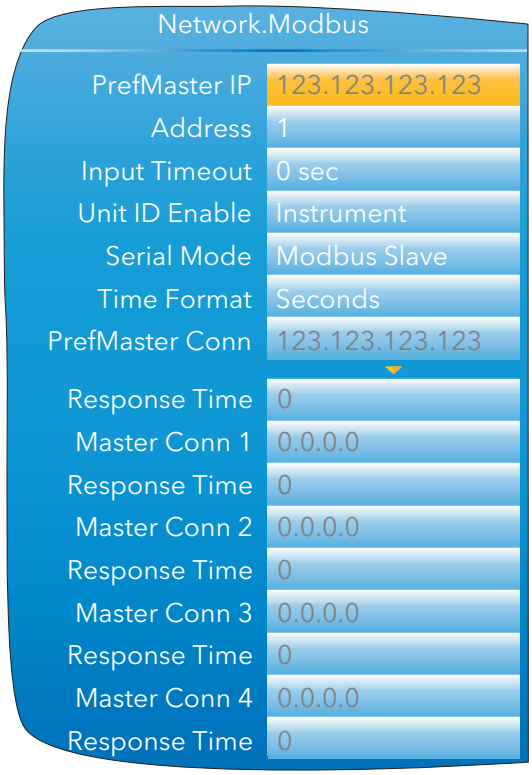


Figure 4.2.4 Modbus TCP configuration menu

PrefMaster IP — The IP address of the relevant Modbus master. The Preferred master is guaranteed to be able to connect, even if all slave connections (max. = 4 for TCP) are in use.

Address — The Modbus address for this slave. This address must be unique for the network to which it is attached. The recorder will respond to this address and to Address 255.

Input Timeout — Allows a value of between 0 and 3600 seconds to be entered to set the timeout period for modbus input channels. If a modbus input is not written to within this period the value of the channel is set to -9999.0 with a 'No Data' status. A value of 0 disables the comms inactivity timeout feature.

Unit ID Enable — Enables/Disables the checking of the Modbus TCP unit identity field.

- Strict — The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds only to Hex value FF in the UIF. iTools finds this instrument only at location 255, and then stops scanning.
- Loose — The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds to any value in the UIF
- Instrument — The Modbus TCP Unit Identity Field (UIF) must match the instrument address or no response will be made to messages.

Serial Mode — Slave communications via the side mounted configuration port interface (CPI) clip (for iTools use.) Parameters: Baud rate 19,200; Parity = none; Number of data bits = 8; Number of stop bits = 1; no flow control. Can be set to 'Modbus Slave' or 'Off'. The unit must be restarted before any change takes effect.

Time Format — Allows the user to choose milliseconds, seconds, minutes or hours as the time format. Sets the resolution for the reading and writing of time format parameters.

PrefMaster Conn — Read only. Shows the IP address of the preferred master, when connected.

Response Time — Read only. Shows the response time for a single communications request to the relevant master.

Master Conn 1 to 4 — Read only. Shows the IP addresses of any other masters connected to this recorder.

4.3 GROUP CONFIGURATION

Group configuration is separated into two areas, one which defines trending characteristics (for display channels) the other defining the recording characteristics for saving data to the Flash memory ready for archiving.

4.3.1 Group Trend configuration

This allows the user to define which points are to be traced on the display and at what interval, and also allows the number of chart divisions to be set up. Figure 4.3.1 shows a typical configuration page.

Note: The background chart colour is set up as a part of Instrument Display configuration (section 4.1.3)

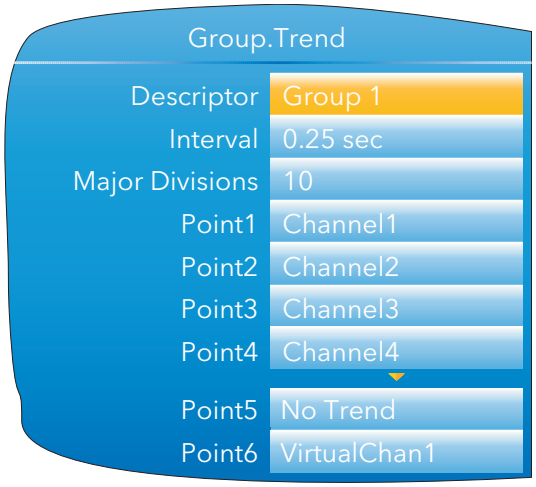


Figure 4.3.1 Group Trend Configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the group.
Interval	The trending interval which defines how much data appears on one screen height or width. A number of discrete intervals can be chosen between 0.125 seconds to 1 hour. The selection should be made according to how much detail is required, and how much data is to be visible on the screen.
Major Divisions	Allows the user to select the number of divisions into which the scale is divided and how many gridlines are displayed. Setting the value to 1 results in just the zero and full scale values appearing. Setting the value to 10 (the maximum) results in a scale with zero, full scale and nine intermediate values appearing, with associated grid lines.
Point1 to Point6	Allows the user to select which channels and virtual channels are to be traced. The maximum number of traces is six.

4.3.2 Group Recording configuration

Similar to Trend configuration, above, but for saving the data to Flash memory history files. Each point can individually be enabled or disabled for recording, or recording can be disabled for the whole group.

Figure 4.3.2 shows a typical page.

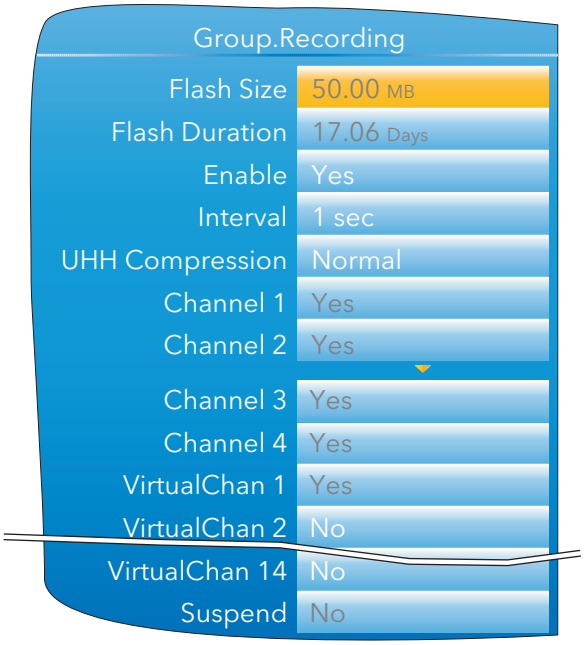


Figure 4.3.2 Group trend recording configuration

Flash Size	Read only. Shows the size of the Flash memory fitted in MB.
Flash Duration	Read only. Shows the time it will take to fill the Flash memory if the recorder configuration remains unchanged.
Enable	'Yes' enables group recording so that all points set to 'Yes' are stored in the recorder's flash memory. 'No' disables group recording.
Interval	Defines the rate at which data is saved to the recorder's Flash memory. The value affects how much trace history appears on the screen in trend history mode.
UHH Compression	Select 'Normal' or 'High'. 'Normal' compresses the data, but still provides an exact copy. 'High' compresses more, but values are saved only to 1 part in 10^8 resolution.

Note: Where very high values are involved, such as in some totaliser values, 'High' compression may cause the value displayed at the recorder, and held in the history file, to be incorrect. The problem may be resolved by changing to 'Normal' compression, or, in the case of a totaliser, by re-scaling it (for example from MegaWatt hours to TeraWatt hours).

Channel 1 to VirtualChan14	Read only (greyed 'yes') for points being trended, (these are automatically recorded). For non-trending points the user may enable or disable each point individually.
Suspend	Ignored unless the user has wired to this field. If wired then when set to 'No' recording is active, when set to 'Yes' recording is paused.

4.4 INPUT CHANNEL CONFIGURATION

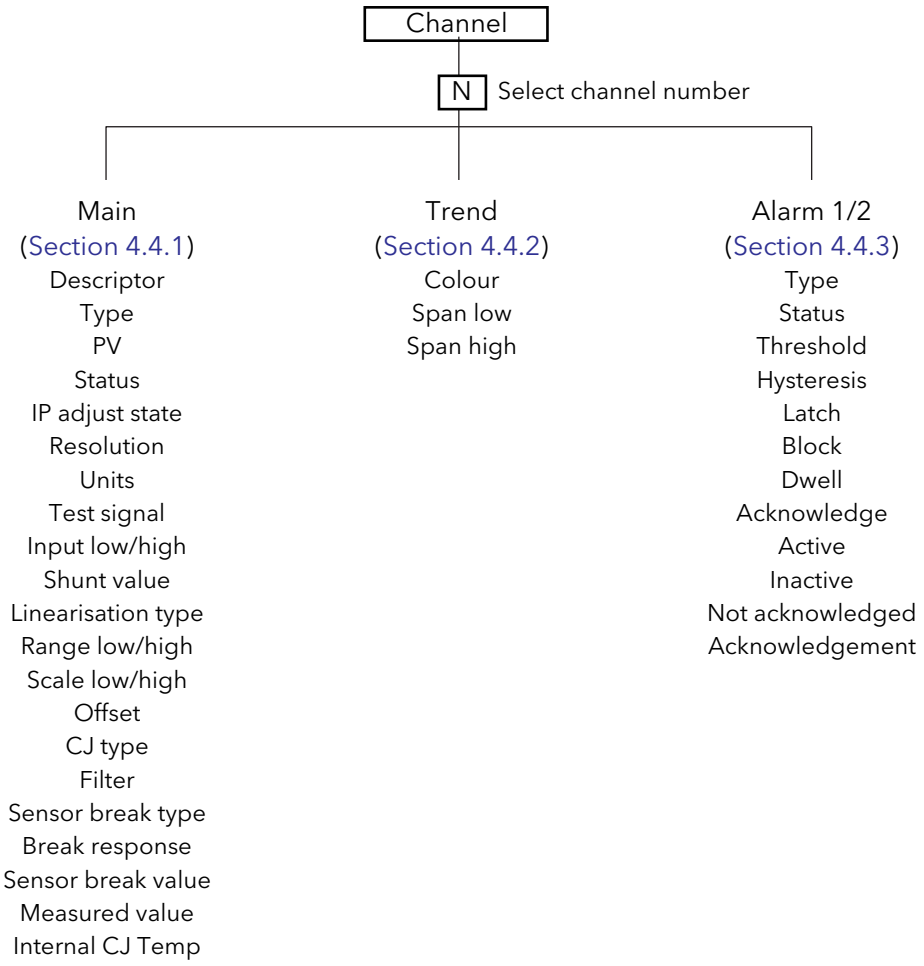


Figure 4.4 Channel configuration menu

4.4.1 Channel Main

This section describes all possible menu items, but it should be noted that some items are context dependent (e.g. Cold Junction settings appear only for Type = 'Thermocouple').

Channels one to four in the configuration relate to An In 1 (terminals 1I, 1+ and 1-) to An In 4 (terminals 4I, 4+ and 4-) respectively - see figure 2.2.

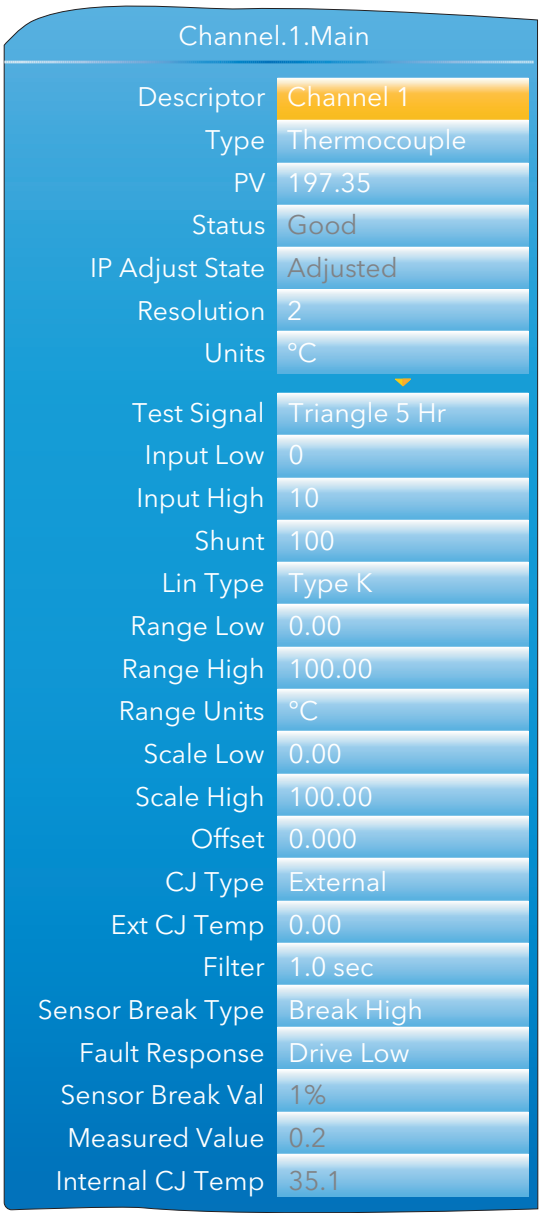


Figure 4.4.1a Channel main menu (expanded)

Note: For the sake of completeness, the figure above shows all possible fields, even though many are mutually exclusive. For example, 'Test signal' appears only when 'Test' is selected as Type. It would never appear when Type = thermocouple (as shown). Similarly, 'Shunt' would appear only for Type = mA.

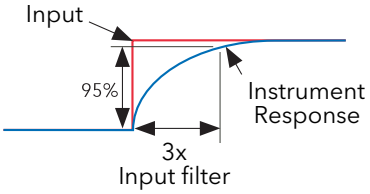
4.4.1 CHANNEL MAIN (Cont.)

Descriptor	Allows a (20 character max.) descriptor to be entered for the channel. Some thought should be given to ensure that the descriptor is meaningful because in some display screens it is truncated. For example, 'Furnace 1 area 1' and 'Furnace 1 area 2' might both appear as 'Furnace 1 a' and thus be indistinguishable from one another, except in background colour.
PV	Read only. Displays the current value of the channel.
Status	Read only. Shows the channel status as one of: 'Good', 'Channel Off', 'Over range', 'Under range', 'HW error', 'Ranging', 'HW (capability) exceeded'.
IP Adjust State	Appears only for channels which have been included in the 'Adjust Input' procedure described in section 4.1.7.
Resolution	Allows the number of decimal places to be defined for the channel. Valid entries are zero to nine.
Units	Allows a units string of up to five characters to be entered.
Type	Allows the user to select an input type for the channel. Available selections are: 'Off', 'Thermocouple', 'mV', 'V', 'mA', 'RTD', 'Digital' or 'Test'.
Test signal	Appears only if 'Test' is selected as 'Type'. Allows either a sinusoidal or a triangular waveform to be selected at one of a number of cycle times between 40 seconds and five hours.
Input Low*	For Type = mV, V or mA, the lowest value of the applied signal in electrical units.
Input High*	For Type = mV, V or mA, the highest value of the applied signal in electrical units.
Shunt value	For input type = mA only, this allows the value of the shunt resistor (in Ohms) to be entered. The recorder does not validate this value - it is up to the user to ensure that the value entered here matches that of the shunt resistor fitted.
Lin type	Linear, Square root, x3/2, x5/2, User Lin. Thermocouple types (alphabetical order): B, C, D, E, G2, J, K, L, N, R, S, T, U, NiMo/NiCo, Platinel, Ni/MiMo, Pt20%Rh/Pt40%Rh. User 1 to User 4 Resistance thermometer types: Cu10, Pt100, Pt100A, JPT100, Ni100, Ni120, Cu53. See Appendix A for input ranges, accuracies etc. associated with the above thermocouple and RTD types. See section 4.8 for details of user linearisations.
Range Low*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the lowest value of the required linearisation range.
Range High*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the highest value of the required linearisation range.
Range Units	For thermocouples only and RTDs, Select °C, °F or K.
Scale Low/High	Maps the process value to (Scale High - Scale Low). For example, an input of 4 to 20mA may be scaled as 0 to 100% by setting Scale low to 0 and Scale High to 100.
Offset	Allows a fixed value to be added to or subtracted from the process variable.

*Note: See section 4.8 for details of the configuration of Range High/Low and Input High/Low when 'Type' = User 1 to User 4.

4.4.1 CHANNEL MAIN (Cont.)

Input filter — Damping can be used to filter out noise from slowly changing signals so that the underlying trend can be seen more clearly. Valid input values are between 0 and 60 seconds.



Note: Applying a filter to an input channel can affect the operation of any Rate-of-change alarms configured to act on that channel.

CJC Type — For thermocouple input types only, this allows the user to select 'None', 'Internal', 'External' or 'Remote 1' to 'Remote 4'.
None: No Cold junction compensation applied.
'Internal' uses the recorder's internal cold junction temperature measurement.
'External' means that the cold junction is to be maintained by the user, at a fixed, known temperature. This temperature is entered in the 'External CJ Temp' field which appears when 'External' is selected.
Remote 1 (2) (3) (4) means that the cold junction temperature is being measured by input channel 1 (2) (3) (4) respectively. (This must be a different channel from that currently being configured).

Ext. CJ Temp — Appears only if CJC type is set to 'External', and allows the user to enter the temperature at which the external cold junction is being maintained.

Sensor Break Type — Defines whether the sensor break becomes active for circuit impedances greater than expected.
'Off' disables Sensor Break detection.
Break Low: Sensor break active if measured impedance is greater than the 'Break Low impedance' value given in table 4.4.1.
Break High: Sensor break active if measured impedance is greater than the 'Break High Impedance' value given in table 4.4.1.

Fault Response — Specifies the behaviour of the recorder if a sensor break is detected or if the input is over driven (saturated high or low).
'None' means that the input drifts, with the wiring acting as an aerial.
'Drive High' means that the trace moves to (Scale High +10%). 'Drive Low' means that the trace moves to (Scale Low -10%), where the 10% values represent 10% of (Scale High - Scale Low).

Sensor Break Val — A diagnostic representation of how close the sensor break detection circuitry is to tripping.

Measured Value — The (read only) input channel measured value before any scaling or linearisation is applied.

Internal CJ temp — The (read only) temperature of the internal cold junction associated with this channel.

Range	Break Low impedance	Break High Impedance
40mV	~5kΩ	~20kΩ
80mV	~5kΩ	~20kΩ
2V	~12.5kΩ	~70kΩ
10V	~12.5kΩ	~120kΩ

Table 4.4.1 Minimum impedances for sensor break detection

Note: Break High impedance values would be used typically for sensors which have a high nominal impedance when working normally

4.4.2 Channel Trend configuration

This area allows the configuration of channel colour and span.

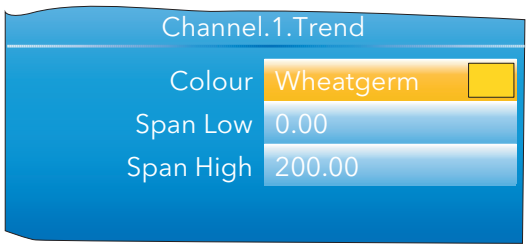


Figure 4.4.2a Channel Trend menu

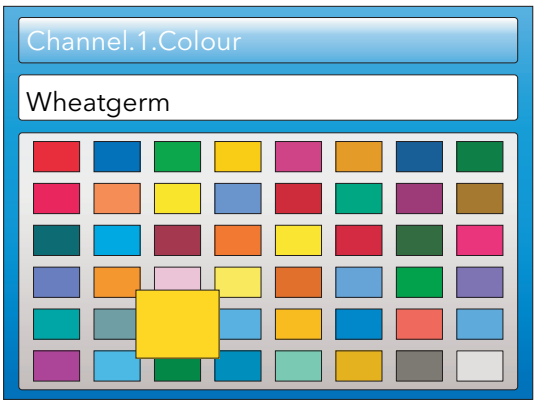


Figure 4.4.2b Colour selection

Colour	Allows a colour to be specified for the channel. The Scroll key is used to enter the colour swatch page. The up and down arrows are used to scroll through the available colours, with each colour being enlarged for as long as it is 'selected'. Once the required colour, is reached, the scroll key is used again to return to the Trend Configuration.
Span Low/High	Span low and high values.

SPAN EXAMPLE

In an input range of 0 to 600 degrees C, the temperature range between 500 and 600 degrees is of most interest. In such a case, Span Low is set to 500 and Span High to 600 so that the recorder trends only the required part of the temperature range, effectively magnifying the area of interest.

> Note: Trending is restricted to the PV range (Span High - Span Low), but the instrument can display values outside this range.

CHANNEL CONFIGURATION EXAMPLE

A type J thermocouple is used to measure a temperature range of 100 to 200 degrees Celsius. This thermocouple output is transmitted to the recorder by a 4 to 20mA transmitter, for display as a value between 0 and 100%.

In Channel.Main, set the following for the relevant channel:

Type	= mA
Units	= %
Input Low	= 4.00
Input high	= 20.00
Shunt	= 250 Ohms
Lin Type	= Type J
Range Low	= 100.00
Range High	= 200.00
Range Units	= °C
Scale Low	= 0
Scale High	= 100

Other items may be left at their defaults.

4.4.3 Alarm 1 menu

Allows the alarm characteristics for Alarm 1 to be configured. The figure below shows a typical configuration page (expanded for clarity). Actual configuration parameters are context sensitive.

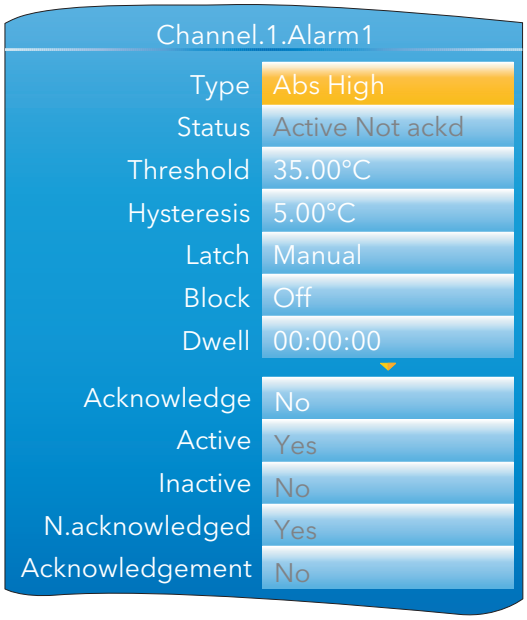


Figure 4.4.3 Typical alarm 1 configuration menu

Type	Select an alarm type from: 'Off', 'Abs. High' (absolute high). 'Abs. Low' (absolute low), 'Dev. High' (deviation high), 'Dev. Low' (deviation low), 'Dev. Band' (deviation band), 'Rise ROC' (rate-of-change: rising), 'Fall ROC' (rate-of-change: falling), 'Digital High', 'Digital Low'. See 'Alarm types', below, for definitions.
Status	Read only. This shows that the alarm is Off, Active, Safe Not Acked or Active Not Acked. For 'Auto' and 'Manual' alarms only, 'SafeNotAcked' means that the alarm trigger source has returned to a non-alarm state, but the alarm is still active because it has not been acknowledged. Similarly, 'ActiveNotAcked' means that the source is still active and the alarm has not been acknowledged.
Threshold	For absolute alarms only, this is the trip point for the alarm. For absolute high alarms, if the threshold value is exceeded by the process value (PV) of this channel, then the alarm becomes active, and remains active until the PV falls below the value (threshold - hysteresis). For absolute low alarms, if the PV of this channel falls below the threshold value, then the alarm becomes active and remains active until the PV rises above (Threshold + Hysteresis).
Reference	For deviation alarms only, this provides a 'centre point' for the deviation band. For 'deviation high' alarms, the alarm becomes active if the process value (PV) rises above the value (Reference + Deviation) and remains active until the PV falls below (Reference + Deviation - Hysteresis). For 'deviation low' alarms, the alarm becomes active if the process value (PV) falls below the value (Reference - Deviation) and remains active until the PV rises above (Reference - Deviation + Hysteresis). For 'deviation band' alarms, the alarm is active whenever the process value (PV) lies outside the value (Reference ± Deviation) and remains active until the PV returns to within the band, minus or plus Hysteresis as appropriate.
Deviation	For deviation alarms only, 'Deviation' defines the width of the deviation band, each side of the Reference value, as described immediately above.
Hysteresis	For absolute and deviation alarms, this provides a means of preventing multiple alarm triggering, if the process value is drifting close to the trigger value.

4.4.3 ALARM 1 MENU (Cont.)

Amount	For rate-of-change alarms only. The alarm becomes active if the process value rises (Rise ROC) or falls (Fall ROC) by more than the specified 'Amount' within the time period defined in 'Change Time', below. The alarm remains active until the rate of change falls below the value (Amount/Change Time) in the relevant sense.
Change Time	Settable to 1 second, 1 minute or 1 hour. See 'Amount' (above).
Average Time	For rate-of-change alarms only. This allows an averaging period (for the process value) to be entered to reduce nuisance trips due to signal noise, or if the rate of change is hovering around the trip value.
Latch	None: the alarm remains active until the monitored value has returned to a non alarm state, when it becomes inactive. Auto: The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement can take place either before or after the value has returned a non alarm state. Manual: The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement is permitted only after the value has returned a non alarm state. Trigger: Not enunciated, this mode is used only to initiate an action defined by user wiring either using iTools or using the user interface.
Block	Alarms with 'Block' set to 'On' are inhibited until the monitored value has entered the 'safe' condition after a start-up. This prevents such alarms from becoming active whilst the process is brought into control. If a latching alarm is not acknowledged then the alarm is re-asserted (not blocked), unless the alarm's threshold or reference value is changed, in which case the alarm is blocked again.
Dwell	Initiates a delay between the trigger source becoming active, and the alarm becoming active. If the trigger source returns to a non alarm state before the dwell time has elapsed, then the alarm is not triggered and the dwell timer is reset.
Acknowledge	Select 'yes' to acknowledge the alarm. Display returns to 'No'.
Active	Read only. Shows the status of the alarm as 'Yes' if it is active, or No, if inactive. The active/inactive state depends on the Latch type (above) and acknowledgment status of the alarm.
Inactive	As for 'Active' above, but shows 'Yes' if the alarm in inactive and 'No' if the alarm is active.
N.acknowledged	As for 'Active' above but shows 'Yes' for as long as the alarm is unacknowledged, and 'No' as soon as it is acknowledged.
Acknowledgement	Fleetingly goes 'Yes' on alarm acknowledgement, and then returns to 'No'.

4.4.4 Alarm 2 menu

As above for Alarm 1 menu.

Note: The parameters 'Acknowledge', 'Active', 'Inactive', 'N(ot) Acknowledged' and, 'Acknowledgement' can all be 'wired' to other parameters, so, for example, a relay can be made to operate whilst the alarm is inactive or whilst it is active or on acknowledgement etc. by wiring the relevant parameter to the relay's 'PV' input. See section 7 for details of user wiring.

4.4.5 Alarm types

The following figures attempt to show graphically the meanings of the alarm parameters which can be set for the various alarm types available.

ABSOLUTE ALARMS

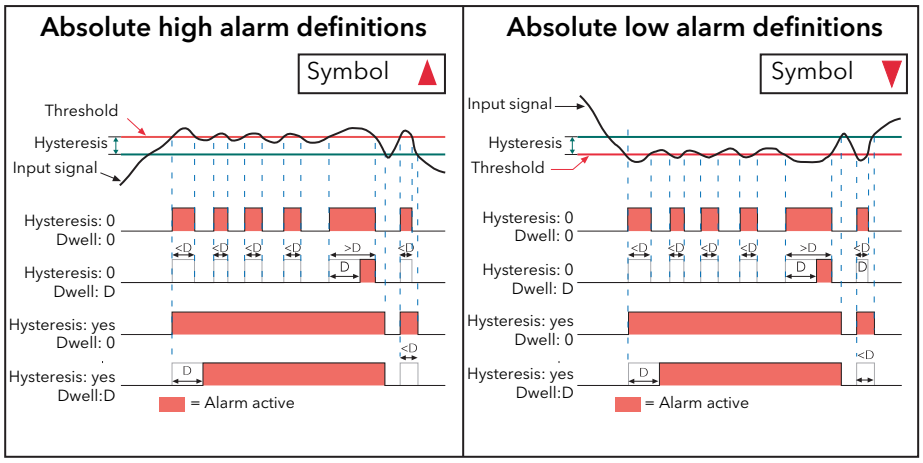


Figure 4.4.5a absolute alarm parameters

DEVIATION ALARMS

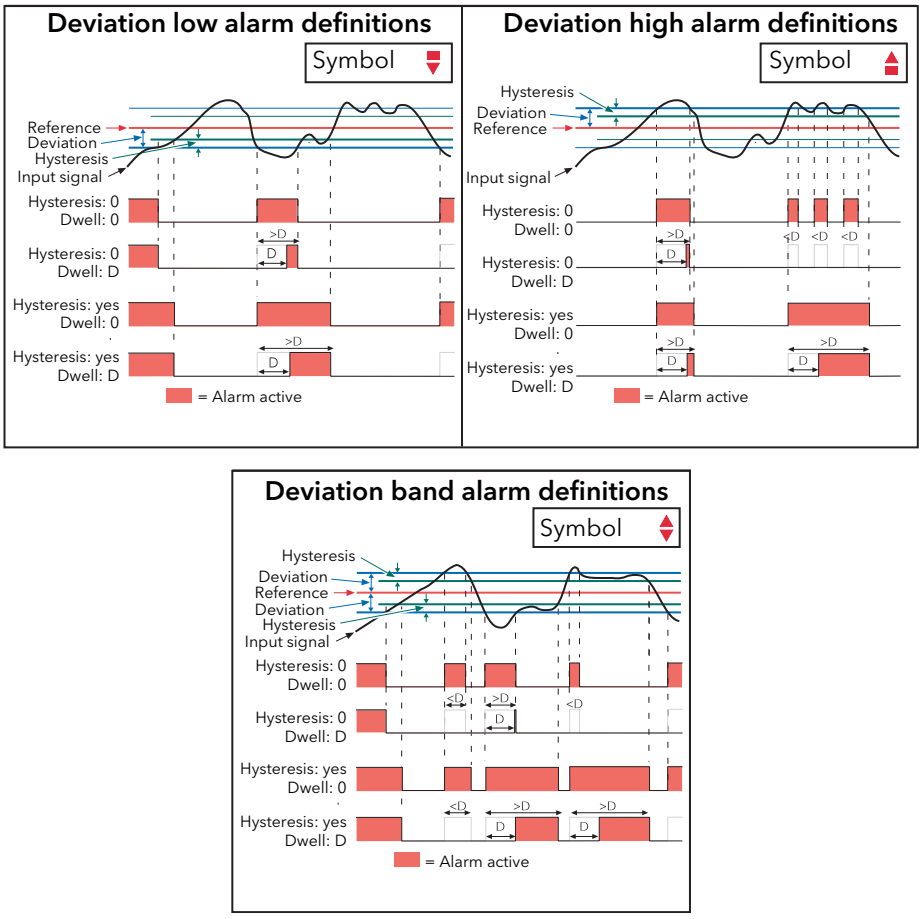


Figure 4.4.5b Deviation alarm parameters

4.4.5 ALARM TYPES (Cont.)

RATE-OF-CHANGE ALARMS

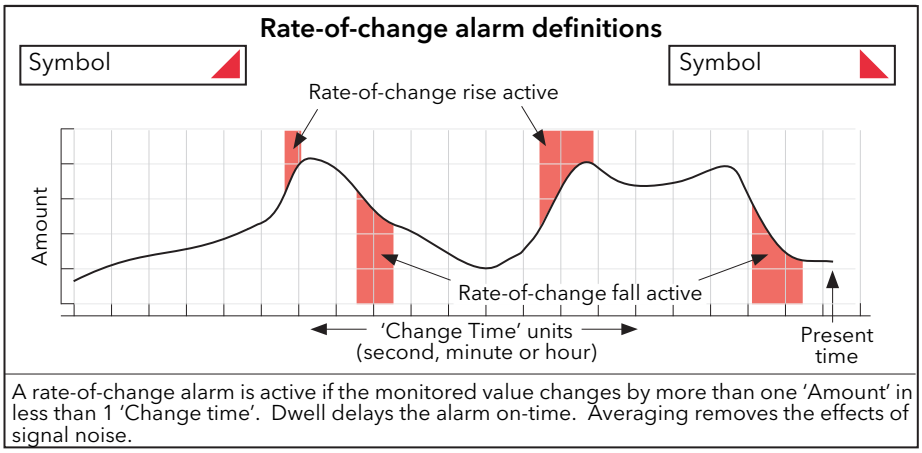

Rate-of-change alarm definitions
Symbol
Symbol
Rate-of-change rise active
Amount
Rate-of-change fall active
'Change Time' units
(second, minute or hour)
Present
time
A rate-of-change alarm is active if the monitored value changes by more than one 'Amount' in less than 1 'Change time'. Dwell delays the alarm on-time. Averaging removes the effects of signal noise.

Figure 4.4.5c Rate-of-change alarm parameters

Note: Operation of rate-of-change alarms may be affected if an input filter (section 4.4.1) is applied to the input signal.

4.5 VIRTUAL CHANNEL CONFIGURATION

This allows the configuration of maths channels totalisers and counters. The configuration is divided into the following areas: 'Main', 'Trend', 'Alarm 1' and 'Alarm 2'. Items appearing in the 'Trend', Alarm 1' and 'Alarm 2' areas are identical with the equivalent items described in section 4.4 (Input channels), above.

4.5.1 Maths channel configuration

The following maths functions are available (listed in up-arrow scroll order)

Off, Add, Subtract, Multiply, Divide, Group Average, Group minimum, Group maximum, Modbus input, Copy, Group minimum (latch), Group maximum (latch), Channel maximum, Channel minimum, Channel Average, Configuration revision, Off.

Figure 4.5.1 shows a typical maths channel configuration

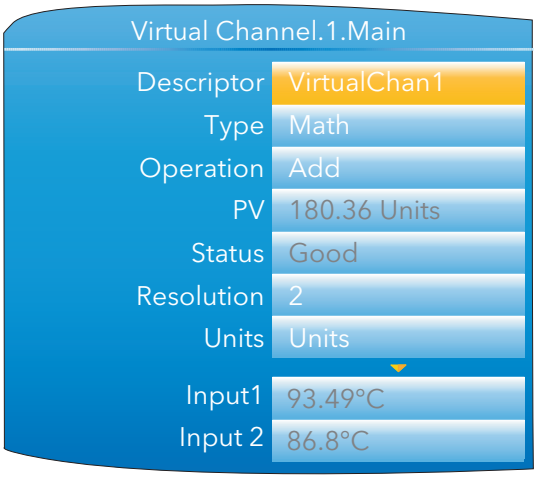


Figure 4.5.1 Maths channel configuration (typical) (expanded)

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the maths channel
Type	Math selected for this example. (See sections 4.5.2 and 4.5.3 for totalisers and counters respectively.)
Operation	Allows the user to select the required maths function. See 'Maths Functions', below.
PV	Read only. Shows the dynamic value of this channel in the units entered in 'Units' below.
Status	Read only. Shows the status of this channel, reflecting the status of the input sources.
Resolution	Enter the number of decimal places required
Units	Allows a five character string to be entered to be used as the channel units.
Input1	The value of input 1. May be entered manually, or it may be wired from another parameter (section 7). Uses the resolution of the source.
Input 2	As for 'Input 1', Appears only when the operation requires two inputs.
Reset	Allows the user to reset latching functions (e.g. Channel Max) or averaging functions (e.g. Channel Avg). Reset is carried out by setting the field to 'Yes', then operating the scroll key. The display returns to 'No'. Alternatively the function can be reset by another parameter wired to 'Reset'.
Time Remaining	The period of time remaining before the virtual channel performs its operation. For example, the time remaining for the maths channel average operation to sample the input before performing the calculation.
Period	For averaging functions, allows the period over which the value is to be averaged to be entered. Selectable periods are: 0.125, 0.25, 0.5, 1, 2, 5, 10, 20, 30 seconds, 1, 2, 5, 10, 20, 30 minutes, 1, 2, 6, 12, 24 hours.

4.5.1 MATHS CHANNEL CONFIGURATION (Cont.)

MATHS FUNCTIONS

Off	Out = -9999; status = Off
Add	Out = Input1 + Input2
Subtract	Out = Input1 - Input2
Multiply	Out = Input1 x Input2
Divide	Out = Input1 ÷ Input2. If Input2 = 0, Out = -9999; Status = 'Bad'.
Group Avg	Out = Instantaneous sum of all points in the group (except this one and any channel that has been configured with operation = group average, group minimum, group maximum, group minimum (latched), group maximum (latched), channel maximum or channel minimum), divided by the number of points in the group (excluding this one). Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Min	Out = Instantaneous value of whichever point (except this one) in the group has the lowest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Max	Out = Instantaneous value of whichever point (except this one) in the group has the highest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Modbus Input	Out = value written to this channel's modbus input. If the comms timeout expires, Out = -9999; status = 'No data'.
Copy	Allows an input or other derived channel to be copied.
Grp Min Latch	Out = Lowest value reached by any point in the group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Grp Max Latch	Out = Highest value reached by any point in the group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Channel Max	Out = Highest value reached by Input1 since last reset. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Min	Out = Lowest value reached by Input1 since last reset. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Avg	Out = the average value of Input1 over the time specified in 'Period'. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Config Revision	Out = current Configuration Revision value.

4.5.2 Totaliser configuration

Totalisers allow the user to maintain a running total of any input channel, or of any maths channel. Using maths channels, it is possible to totalise combinations of input channels so that, for example, the sum of two channels or the difference between them could be totalised if required.

The maximum capacity for each totaliser is 1,000,000. This range can be expanded by wiring from the 'Roll-over' output of the totaliser to the 'trigger' input of a counter. Wiring is carried out either at the operator interface (section 7) or in iTools (section 6).

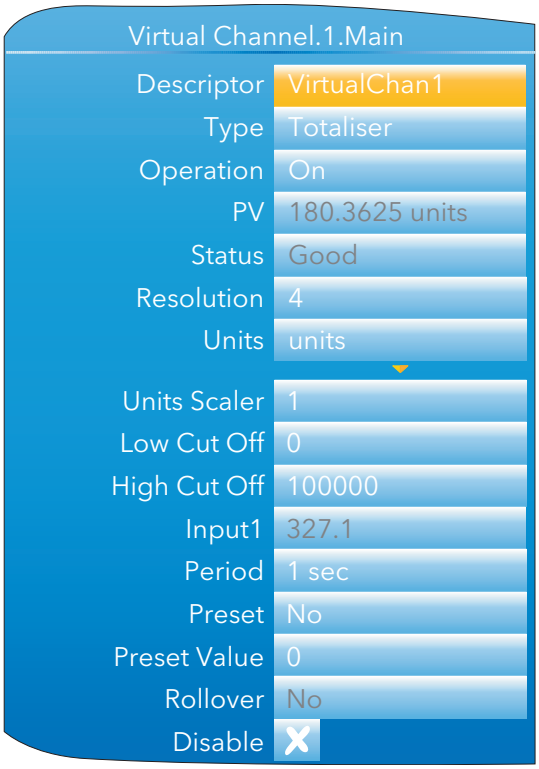
The totaliser equation is:

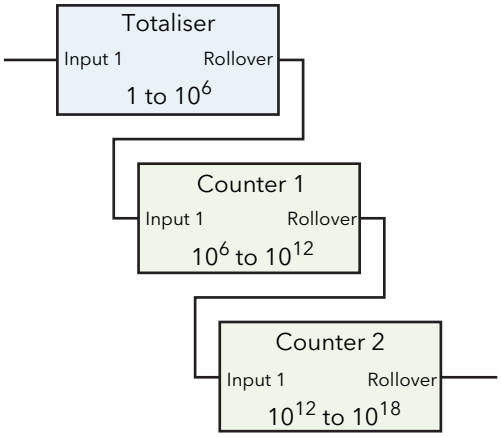
$$tot_t = tot_{t-1} + \frac{ma_t}{PSF \times USF}$$ where,

tot_t = totaliser value this sample
tot_{t-1} = totaliser value last sample
ma_t = process value this sample
PSF = Period Scaling Factor (Period)
USF = Units Scaling Factor (Units scaler)

Note: the time between samples is 125ms.

Figure 4.5.2 shows a typical configuration page.





Using cascaded counters to expand the totalisation range.

Figure 4.5.2 Typical totaliser configuration menu

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the totaliser.
Type	Select: Math, Counter or Totaliser.
Operation	Allows the user to enable ('On') or disable ('Off') the totaliser.
PV	Read only. Shows the dynamic value of the totaliser.

4.5.2 TOTALISER CONFIGURATION (Cont.)

Status	Read only. Shows the status of the totaliser.

Notes:

1. Because of the way in which the totaliser value is stored (IEEE 32-bit floating point), it is possible that if the current totaliser value is very large, then very small input values can be smaller than the minimum that can be resolved. In such a case the small value is not totalised, and the status 'Overflow' is set. This should not be confused with 'Rollover', described below.
2. The incremental value (ma/(PSF*USF)) at the rollover point (1,000,000) should be ≥ 1.

Resolution	Allows the number of decimal places (up to 6) to be selected for the totaliser.
Units	Allows a units string of up to five characters to be entered for the totalised value.
Units Scaler	Allows a units scaler to be selected. If, for example, the input channel has units of litres per hour, then, if the Units Scaler is set to one, the totalised value will be in litres. If the Units Scaler is set to 1000, then the totalised value will be in thousands of litres. Setting the Units Scaler to a negative value, causes the totaliser to decrement rather than increment.
Low Cut Off	Used to restrict the input operating range of the totaliser. Minimum value = -100 000
High Cut Off	Used to restrict the input operating range of the totaliser. Maximum value = 100 000
Input1	The value of the source. May be entered manually, or this parameter can be wired from an external channel PV.
Period	The totaliser equation works in seconds. If the totalised channel units are other than 'per second', a period scaler different from the default (1 sec) must be used. The 'Period' field presents a number of fixed periods from 0.125 seconds to 24 hours for selection.
Preset	Setting this to 'Yes' causes the totaliser to adopt the Preset Value. The field returns immediately to 'No'. The totaliser can also be preset by an external source 'wired' to this parameter.
Preset Value	Allows the entry of a value, from which the totaliser is to start incrementing or decrem enting. The direction of the count is set by the sign of the units scaler: positive = increment; negative = decrement.
Rollover	The maximum capacity of the totaliser is 1 000 000. If, for example, the current totaliser value is 999 999 and 'Input 1' = 10, then the next sample will set the totaliser value to (999,999 +10 - 1,000,000 = 9) and 'Rollover' is set to 'Yes' for one iteration period. This can be used to increment a counter by wiring the totaliser 'Rollover' parameter to the 'Trigger' parameter of the counter. The maximum capacity of each counter is also 1 million and if necessary, counters can be cascaded in a similar way, the first counter counting in millions, the second in units of 10^{12}, the third in units of 10^{18}, and so on.
Disable	Allows the user temporarily to suspend totalising action. The output retains the pre-disabled value until the totaliser is re-enabled, when it resumes from that value. The totaliser is toggled between being enabled (cross symbol) and disabled (tick symbol) by means of the scroll key.

4.5.3 Counter configuration

This allows the user to set up a counter to count trigger inputs (or it may be incremented from the Configuration page. Maximum count is 1 000 000. Counters can be cascaded by wiring from 'Rollover' of one counter to 'trigger' of the next. Wiring is carried out from the operator interface (section 7) or in iTools (section 6). For 'Trend', 'Alarm 1' and 'Alarm 2' configurations please see the relevant parts of section 4.4.

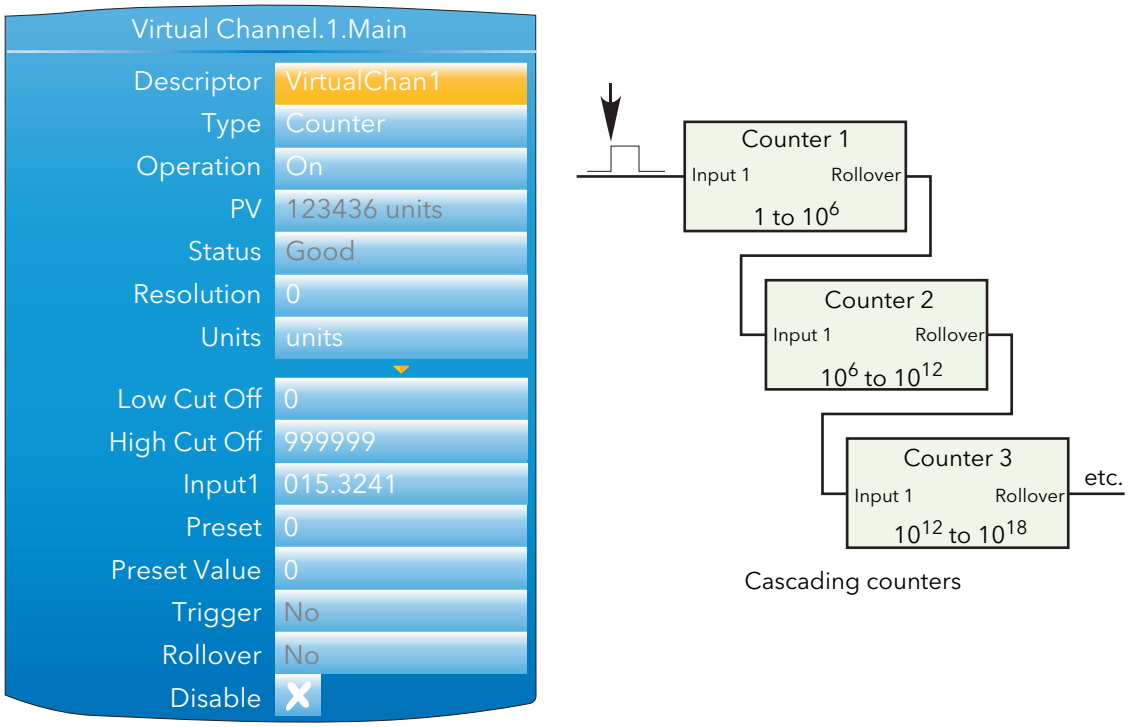


Figure 4.5.3 Typical Counter configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the counter.
Type	Select: Math, Counter or Totaliser.
Operation	Allows the user to enable ('On') or disable ('Off') the counter.
PV	Read only. Shows the dynamic value of the counter.
Status	Read only. Reflects the status of the input channel.
Resolution	Allows the number of decimal places (up to six) to be defined for the channel.
Units	Allows a units string of up to five characters to be entered for the counter value
Low Cut Off	Specifies a value below which the counter will not decrement.
High Cut Off	Specifies a value above which the counter will not increment.
Input1	The amount by which the counter is incremented each time 'Trigger' goes high. The value may be entered manually, or wired from another parameter. Negative values cause the counter to decrement.
Preset	Setting this to 'Yes' causes the counter to adopt its Preset Value. The field returns immediately to 'No'. The counter can also be preset by wiring from another parameter.
Preset Val	Allows the entry of a value, from which the counter is to start incrementing or decrementing.
Trigger	Setting this to 1, causes the current value of the input source to be added to the Counter value. This function can be carried out manually, or the input can be wired from another parameter (section 7.2).
Rollover	The maximum capacity of the counter is 1 000 000. If, for example, the current value is 999 999 and Input 1 = 15, then the next sample will set the totaliser value to 14 (999,999 +15 - 1,000,000) and 'Rollover' is set to 'Yes' for one iteration period. This can be used to increment a further counter by wiring 'Rollover' to 'Trigger'.
Disable	Allows the user temporarily to suspend counting. The output retains the pre-disabled value until the counter is re-enabled, when it resumes counting from that value. The counter is toggled between being enabled (cross symbol) and disabled (tick symbol) by means of the scroll key.

4.6 LOOP CONFIGURATION

This configuration area allows the user to set up two control loops. This description refers to temperature control loops, but the configuration parameters apply equally to other types of control. For each loop, channel 1 is assumed to be a heating channel; channel 2 a cooling channel.

The configuration is divided into a number of areas, as shown in the overview below.

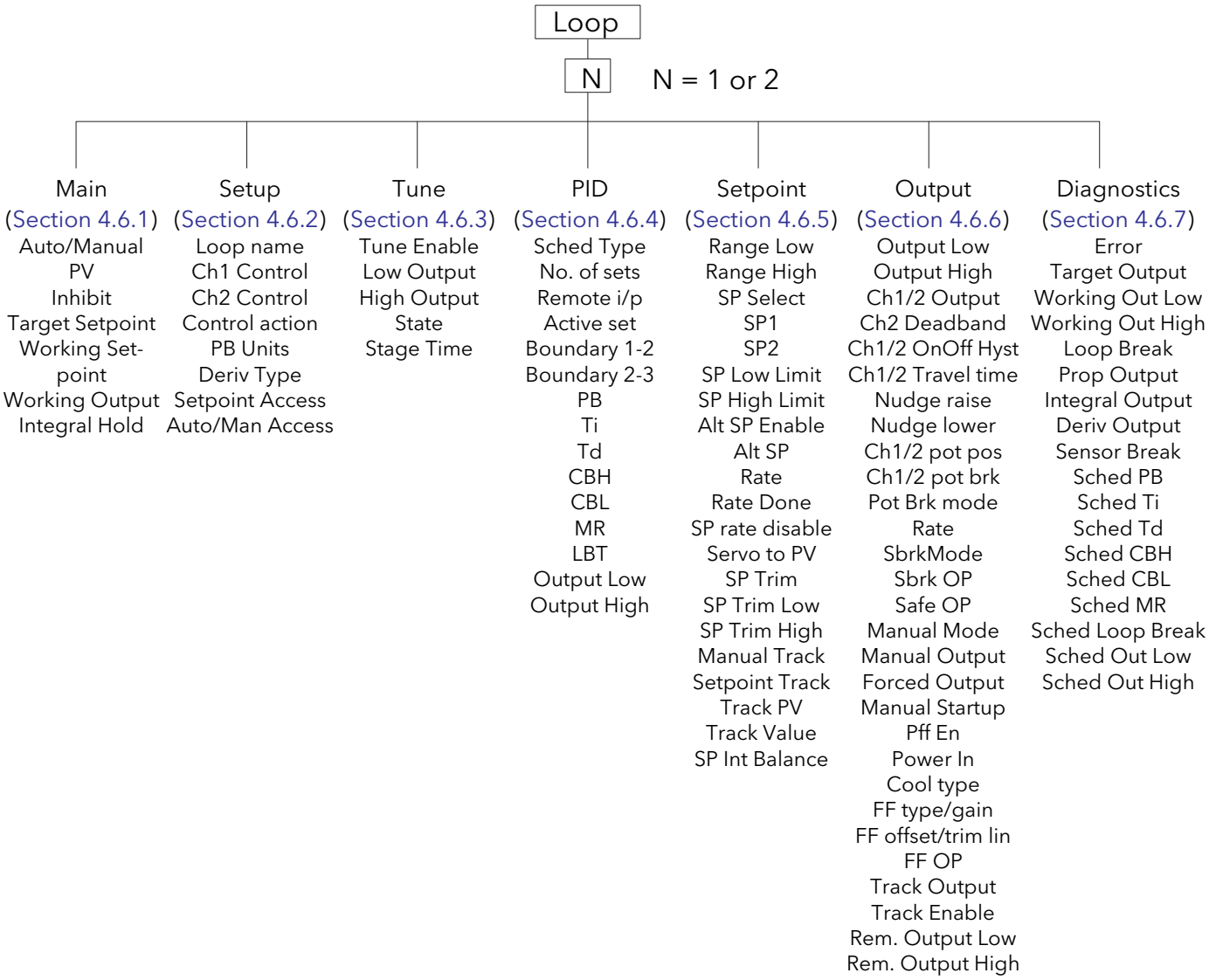


Figure 4.6 Loop configuration overview

For a general discussion of control loops, please see Appendix B to this manual.

4.6.1 Main menu parameters

Auto/Manual	Selects Auto(matic) or Manual operation. 'Auto' automatically controls output power in a closed loop configuration. In manual mode, the operator controls the output power.
PV	The Process Variable input value. The value can be entered by the user, but is most often 'wired' from an analogue input.
Inhibit	Select 'No' or 'Yes'. 'Yes' stops the loop and sets the output to a 'safe' value, this value being entered as a part of the Output configuration (section 4.6.6). If an output rate limit is set, then the output ramps to the safe level at that rate, otherwise it performs a step change. If setpoint or manual tracking is enabled (in setpoint configuration section 4.6.5), Inhibit overrides tracking. If 'No' is selected, the loop operates normally. Inhibit can be enabled/disabled from an external source.
Target Setpoint	The value at which the control loop is aiming. SP may be derived from a number of sources, as described in Appendix B, section B2.5. The value range limited by the setpoint limits (SP High Limit and SP Low Limit) described in section 4.6.5.
Working Setpoint	A read-only value displaying the current value of setpoint being used by the loop. This might or might not be the Target setpoint. The value may come from a number of sources, but is limited by the setpoint limits (SP High Lim and SP Low Lim) described in section 4.6.5.
Working Output	The actual working output value before being split into channel 1 and 2 outputs.
Integral Hold	Select 'Yes' or 'No'. 'Yes' freezes the integral term at its current value. IntHold ensures that the power is reapplied smoothly after the loop has been broken for service reasons, for example.

4.6.2 Setup menu parameters

Loop Name	Allows entry of an 11 character name for the loop.
Ch1 Control	Selects the type of control for channel one from: Off: Channel is turned off OnOff: Channel uses on/off control PID: Proportional + integral + derivative (three-term) control. VPU: Valve positioning unbounded VPB: Valve positioning bounded. Appendix B, Section B2.2 provides more details.
Ch2 Control	As above, but for loop channel two.
Control Action	Select 'Reverse' or 'Direct'. 'Reverse' means that the output is 'on' when the process value (PV) is below the target setpoint (SP). This is normal for heating control. 'Direct' means that the output is on when PV is above SP. This is normal for cooling control.
PB Units *	Select 'Engineering' or 'Percent'. 'Engineering' displays values in (for example) temperature units (e.g. °C or °F). 'Percent' displays values as a percentage of loop span (Range Hi - Range Lo).
Deriv Type *	'Error' means that changes to PV or SP cause changes to the derivative output. Derivative on error should be used with a programmer since it tends to reduce ramp overshoot. 'Error' provides rapid response to small setpoint changes which makes it ideal for temperature control systems. 'PV' means that changes in PV alone cause changes to the derivative output. Typically used for process systems using valve control, as it reduces wear on the valve mechanics.
Setpoint Access	Allows setpoint editing permission in the loop display pages (section 3.4.6). 'Read/Write' allows free access to all users 'Read Only' allows editing only in Configuration or Supervisor modes. 'Operator R/W' allows editing in all modes except 'Logged out'.

4.6.2 SETUP MENU PARAMETERS (Cont.)

Auto/Man Access — As 'Setpoint Access' above, but for Auto/manual parameter.

*Note: 'PB Units' and 'Deriv Type' appear only if at least one of Ch1 Control and Ch2 Control is set to 'PID', 'VPU' or' VPB'.

4.6.3 Tune menu parameters

Tune Enable	'On' initiates autotune. Legend changes to 'Off' when autotune is complete. Can be set to 'Off' manually, to stop the tuning process.
Low Output	Sets a low limit to be imposed whilst autotune is running. The value must be greater than or equal to the 'Output Low' value, specified in the Output menu (section 4.6.6).
High Output	Sets a high limit to be imposed whilst autotune is running. The value must be less than or equal to the 'Output High' value, specified in the Output menu (section 4.6.6).
State	Read only display of autotune progress: Off. Autotune not running Ready. Fleeting display. Changes immediately to 'Running'. Running. Autotune is in progress. Complete. Autotune completed successfully. This is a fleeting display which changes immediately to 'Off'. Timeout, TI Limit and R2G Limit are error conditions described in Appendix B section B2.4.5. If any of these occurs, tuning is aborted and the PID settings remain unchanged.
Stage	A read only display showing the progress of the autotune: Settling. Displayed during the first minute whilst loop stability is checked (Appendix B, section B2.4.5) To SP. Heating or cooling switched on. Wait min. Power output off. Wait max. Power output on. Timeout, TI Limit and R2G Limit are error conditions described in Appendix B section B2.4.5.
Stage Time	Time into the current stage of the autotune process. 0 to 99999 seconds.
AT.R2G	Autotune at R2G. 'Yes' means that the control loop uses the R2G value calculated by autotune. 'No' causes the loop to use the R2G value entered by the user (PID menu) calculated as described in Appendix B section B2.4.5.

4.6.4 PID menu parameters

Note: If control type is set to 'Off', or 'OnOff' in the Setup menu, the PID menu contains only the Loop Break time parameter 'LBT'.

Sched Type	Selects the type of gain scheduling (section B2.3.7) to be applied. Off. Gain scheduling not active Set. The user selects the PID parameter set to be used. Setpoint. Transfer from one set to the next depends on the setpoint value PV. The transfer from one set to another depends on the PV value Error. The transfer between sets depends on the value of the error signal OP. Transfer depends on the value of the output. Rem. Transfer is controlled by a remote input.
Number of Sets	Allows the number of sets of PID parameters for use in Gain scheduling to be selected.
Remote input	For 'Sched Type' = 'Rem' only, this shows the current value of the remote input channel being used to select which set is active. If the remote input value ≤ the Boundary 1-2 value (see below) then set 1 is selected. If it is > Boundary 1-2 value but ≤ Boundary 2-3 value then set 2 is used. If the remote value is > Boundary 2-3 value, then set three is used. If the Remote input is not 'wired', the value is user editable from the front panel.
Active Set	The set number currently in use.
Boundary 1-2	For all Sched Types except 'Set', this allows the user to enter a 'boundary' value, which means that if the relevant value (SP, PV, Error etc.) rises above this boundary, the loop switches from PID set 1 to PID set 2. If it falls below the boundary value, the loop switches from set 2 to set 1.
Boundary 2-3	As above but for switching between sets 2 and 3.
PB/PB2/PB3	Proportional band for set one/two/three. The proportional term in the units (Engineering units or %) set in 'PBUnits' in the Setup menu. See Appendix B section B2.2.2 for more details.
Ti/Ti2/Ti3	Integral time constant for set one/two/three. Valid entries are1 to 9999.9 seconds, or 'Off'. If set Off, then integral action is disabled. Removes steady state control offsets by moving the output up or down at a rate proportional to the error signal.
Td/Td2/Td3	Derivative time constant for set one/two/three. Valid entries are 1 to 9999.9 seconds, or 'Off'. If set Off, then derivative action is disabled. Determines how strongly the controller reacts to a change in the PV. Used to control overshoot and undershoot and to restore the PV rapidly if there is a sudden change in demand.
R2G/R2G2/R2G3	Relative cool gain for set one/two/three. Appears only if cooling has been configured (Ch2 Control not 'Off' or 'OnOff' in Setup menu). Valid entries are 0.1 to 10. Sets the cooling proportional band which compensates for differences between heating and cooling power gains.
CBH/CBH2/CBH3	Cutback high for set one/two/three. Valid entries 'Auto' (3×PB) or 0.1 to 9999.9. The number of display units above setpoint at which the controller output is forced to 0% or -100% (OP min), in order to modify undershoot on cool down. See section B2.3.2 for more details.
CBL/CBL2/CBL3	Cutback low for set one/two/three. Valid entries 'Auto' (3×PB) or 0.1 to 9999.9. The number of display units below setpoint at which the controller output is forced to 100% (OP max), in order to modify overshoot on heat up. See section B2.3.2 for more details.
MR/MR2/MR3	Manual reset for set one/two/three. Valid entries 0 to 100%. Introduces a fixed additional power level to the output in order to eliminate steady state error from proportional only control. Applied instead of the integral component when Ti is set to 'Off'.
LBT/LBT2/LBT3	Loop break time for set one/two/three. valid entries are 1 to 99999 seconds, or 'Off'. See section B2.3.6 for more details.
Output Low/2/3	Output low limit for set one/two/three. Valid entries are in the range Output High/2/3 to -100.
Output High/2/3	Output high limit for set one/two/three. Valid entries are in the range Output Low/2/3 to +100

4.6.5 Setpoint menu parameters

Range High/Low	Range limits. Valid entries from 99999 to -99999. Range limits set absolute maxima and minima for control loop setpoints. If the proportional band is configured as a % span, the span is derived from the range limits.
SP select	Select SP1 or SP2. SP1 is considered to be the primary setpoint for the controller, and SP2 a secondary (standby) setpoint.
SP1, SP2	Allows values for Setpoints 1 and 2 to be entered. Valid entries are any within the range 'SPHigh Limit' to 'SPLowLim'.
SP Low Limit	Minimum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Lo' and 'SP High Limit'
SP High Limit	Maximum setpoint limit for SP1 and SP2. Valid entries are in the range 'Range Hi' and 'SP LowLim'
Alt SP Enable	'Yes' enables the alternative setpoint; 'No' disables it. May be wired to an external or internal source.
Alt SP	When wired this is a read only display of the alternative setpoint value. Otherwise, the user may insert a value. Valid values are limited by 'Range Hi' and 'Range Lo'.
Rate	Sets the maximum rate at which the working setpoint may change. Often used to protect the load from thermal shock cause by large step changes in setpoint. Valid entries are 0.1 to 9999.9 engineering units per second, or 'Off'.
RateDone	Read only display. 'Yes' indicates that the working setpoint has completed its change. 'No' indicates that the setpoint is still ramping.
SP Rate Disable	Appears only if Rate is not 'Off'. 'Yes' disables rate limiting; 'No' enables rate limiting.
Servo To PV	If 'Rate' is set to any value other than 'Off', and if 'Servo to PV' is set to 'Yes' then any change in the current setpoint value causes the working setpoint to servo to the current PV before ramping to the new setpoint value.
SPTrim	A positive or negative value added to the setpoint, for local fine tuning. Valid entries are any value between 'SP Trim High' and 'SPTrim Low'.
SP Trim High/Low	Setpoint trim high and low limits
Manual Track	'On' enables manual tracking to allow the local SP to follow the value of the current PV. See section B2.5.5 for more details. 'Off' disables manual tracking.
Setpoint Track	'On' enables setpoint tracking to allow the local SP to follow the value of the alternative SP. See section B2.5.4 for more details. 'Off' disables setpoint tracking.
Track PV	The unit tracks the PV when it is servoing or tracking.
Track Value	The SP to track in manual tracking
SP Int Balance	Allows the user to enable (tick) or disable (cross) debump on PV change.

4.6.6 Output menu items

Appendix B section B2.6 contains details of the output functions.

Output Low	The minimum power, or the maximum 'negative' (i.e. cooling) power to be delivered by the system. The valid input range is -100% and Output High.
Output High	The maximum output power to be delivered by channels 1 and 2, where 100% is full power. The valid input range is Output Low to 100.0%. Reducing this value reduces the rate of change of the process, but it also reduces the controller's ability to react to perturbations.
Ch1 Output	Displays the positive power values used by the heat output. Values range from Output low to Output high
Ch2 Output	Displays the cooling power values for channel two. Appears as a value between Output high and -100%, where -100% represents full cooling power.
Ch2 Deadband	A gap (in %) between output 1 switching off, and output 2 switching on, and *vice-versa*. Valid inputs are 0 (off) to 100%.
Rate	Limit on the rate at which the output from the PID can change. Can be useful in preventing rapid changes in output that could damage the process, heater elements etc.
Ch1 OnOff Hyst	Appears only if 'Ch1 Control' has been set to 'OnOff' in the Setup menu. Allows the user to enter a hysteresis value for channel one. Valid entries are 0.0 to 200.0.
Ch2 OnOff Hyst	Appears only if 'Ch2 Control' has been set to 'OnOff' in the Setup menu. Allows the user to enter a hysteresis value for channel two. Valid entries are 0.0 to 200.0.
Ch1 Travel Time	Appears only if Setup menu parameter 'Ch1 Control' is set to 'VPB' or 'VPU'. This is the valve travel time from closed (0%) to open (100%). In a valve positioning application, channel 1 output is connected by a single software 'wire' to a Valve Raise/Valve Lower relay pair. For heat/cool applications, channel 1 is associated with the heating valve. Valid entries: 0.0 to 1000.0 seconds.
Ch2 Travel Time	Appears only if Setup menu parameter 'Ch2 Control' is set to 'VPB' or 'VPU'. This is the valve travel time from closed (0%) to open (100%). For heat/cool applications, channel 2 is associated with the cooling valve. Valid entries: 0.0 to 1000.0 seconds.
Nudge Raise	Appears only if Setup menu parameter 'Ch1 Control' or Ch2 Control is set to 'VPU'. If set to 'Yes', the valve can be moved towards the open position by, for example, a contact closure, an up arrow button operation or a serial communications command. The default minimum nudge time is 125 ms, but this can be edited in the relevant relay configuration - see section 4.7.2. See also Section B2.6.10 for more 'Nudge' details.
Nudge Lower	As for 'Nudge Raise', above but moves the valve towards the closed position.
Ch1 Pot Pos*	The position of the channel one actuator as measured by the feedback potentiometer.
Ch1 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Ch2 Pot Pos*	The position of the channel two actuator as measured by the feedback potentiometer.
Ch2 Pot Brk*	'On' indicates that the input to the relevant channel is open circuit.
Pot Brk Mode*	Defines the action to be taken if a potentiometer break is detected: Raise: opens the valve Lower: closes the valve Rest: the valve remains in its current state. Model: the controller tracks the position of the valve and sets up a model of the system so that it continues to function if the potentiometer becomes faulty.

* Note: These parameters appear only if the 'Setup' menu parameter 'Ch1 Control' or 'Ch2 control' (as appropriate) is set to 'VBP'. The Setup menu is described in section 4.6.2.

4.6.6 OUTPUT MENU PARAMETERS (Cont.)

SBrk Mode	Defines the action to be taken in the event of a sensor break. Safe: The output adopts the value configured in 'Sbrk OP', below. Hold: The output remains at its current level.
Sbrk OP	The value to be output if a sensor break occurs, and SBrk Mode (above) is set to 'Safe'.
Safe OP	The output level adopted when the loop is inhibited (Main menu section 4.6.1).
Manual Mode	Selects the type of transition to occur when changing to manual mode (section 4.6.1): Track: Whilst in Auto mode, the manual output tracks the control output so that there is no change of output when manual mode is switched to. Step: On transition to manual mode, the output is set to the value entered for 'Forced-OP' (below). Last Man. Out: On transition to manual mode, the output adopts the manual output value as last set by the operator.
Manual Output	The output when the loop is in manual mode. In manual mode the controller limits the maximum power, but it is not recommended that it be left unattended at high power settings. It is important that over range alarms are fitted to protect the process.

Note: It is recommended that all processes are fitted with an independent over range detection system.

Forced Output	Forced Manual output value. When 'Manual Mode' = 'Step', this is the output value adopted when changing from Auto to Manual mode.
Manual Startup	When set to off (cross symbol), the controller powers up in the same (auto or manual) mode that obtained when it was switched off. When set to on (tick symbol) the controller always powers up in manual mode.
Pff En	Power feed forward enable. 'Yes' enables power feed forward (adjusts the output signal to compensate for variations is supply voltage. 'No' disables Pff. See section B2.6.6 for further details.
Power In	Read only display of the current supply voltage.
Cool Type	Appears only if 'Ch2 Control' = 'PID' in the setup menu (section 4.6.2) and allows the user to enter the appropriate type of cooling (section B2.6.7): Linear: For use when controller output changes linearly with PID demand. Oil: For oil cooled applications Water: For water cooled applications Fan: For forced air cooling.
FF Type	Feed forward type (section B2.6.8): None: No signal fed forward. Remote: A remote signal fed forward. SP: Setpoint is fed forward. PV: PV is fed forward.
FF Gain	For FF types 'PV' and 'SP', this scales the feed forward signal.
FF Offset	For FF types 'PV' and 'SP', this defines the offset of the scaled feed forward signal.
FF Trim lim	For FF types 'PV' and 'SP', defines symmetrical limits about the PID output which are applied to the scaled feed forward signal.
FF OP	For FF types 'PV' and 'SP', this is the calculated (scaled, offset and trimmed) feed forward signal. FF OP = FF gain (input + FF Offset)
Track Output	If 'Track Enable' (below) is set to 'Yes', this is the value for the control output. PID remains in Auto mode and tracks the output. The Track OP value can be wired to an external source, or can be entered via the front panel. Similar to entering manual mode.
Track Enable	When set to 'Yes', the output follows the Track OP value (above). When subsequently set to 'Off' the loop makes a bump less return to control.
Reluctantly)	Used to limit the output using a remote source. These limits cannot exceed the 'Output Low' and 'Output High' values described earlier in this section.

4.6.7 Loop diagnostics

These 'parameters' are read only unless otherwise stated.

Error	The difference in value between the setpoint and the PV.
Target Output	The requested control output. The target of the active output if rate limiting is active.
Working Out Low	The low limit for the working output. This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Working Out High	The high limit for the working output. This is the value used to limit the output power of the loop and is derived from the gain scheduled limit, the remote limit and the safety limit.
Loop Break	Loop Break Alarm. Becomes active 'Yes' if the loop break time (LBT), set in the PID menu (section 4.6.4) is exceeded, otherwise 'No' is displayed.
Prop. Output	Shows the proportional term contribution to the control output
Integral Output	Shows the integral term contribution to the control output
Deriv. Output	Shows the derivative term contribution to the control output
Sensor Break	Indicates sensor break status. On (tick symbol) indicates a sensor break has occurred; Off (cross symbol) shows that no sensor breaks have been detected.
Sched PB	The scheduled proportional band for the current PID set.
Sched Ti	The scheduled integral time for the current PID set.
Sched Td	The scheduled derivative time for the current PID set.
Sched R2G	The scheduled relative cool gain value for the current PID set.
Sched CBH	The scheduled cutback high value for the current PID set.
Sched CBL	The scheduled cutback low value for the current PID set.
Sched MR	The scheduled manual reset value for the current PID set.
Sched Loop Break	The scheduled loop break time for the current PID set.
Sched Out Low	The scheduled output low limit for the current PID set.
Sched Out High	The scheduled output high limit for the current PID set.

4.7 DIGITAL I/O

This area of configuration allows the digital I/O types to be selected.

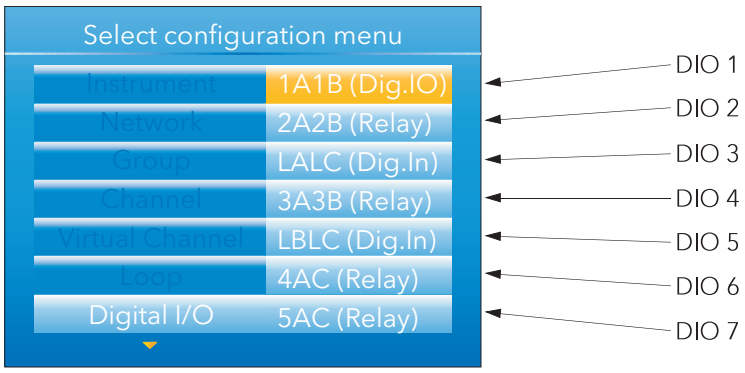


Figure 4.7 Digital I/O top level menu

4.7.1 Digital input/output

This applies to signals at terminals 1A/1B (figure 2.2)

Type	'On Off O/P', 'Time Prop O/P' or 'Contact I/P' (default)
PV	For inputs, 0 = contact is open; 1 = contact is closed. For On Off O/P, a value ≥ 0.5 drives the output high, otherwise, the output is driven low. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for digital outputs; or the input signal for digital inputs.
Output	Off = output being driven low; On = output being driven high. Does not appear for Type = Contact I/P

4.7.2 Relay outputs

This applies to terminal pairs 2A2B, 3A3B, 4AC, 5AC (figure 2.2).

Type (2A2B, 4AC)	'On Off O/P' (default), 'Time Prop O/P', Valve Raise.
Type (3A3B, 5AC)	'On Off O/P' (default), 'Time Prop O/P'.
PV	For On Off O/P, a value ≥ 0.5 closes the relay contacts, otherwise, the contacts are open. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified to reduce relay wear. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for the relays (not applicable if Type = Valve Raise).
Inertia	For Type = Valve Raise only, this allows a value to be entered (in seconds) to take into account valve run-on.
Backlash	For Type = Valve Raise only, this allows a value to be entered (in seconds) in order to compensate for backlash in the valve linkage.
Standby action	For Type = Valve Raise only, this specifies the valve action when the instrument is in standby mode. Continue: Output continues at the demanded level Freeze: The valve stops being driven.
Output	Off = relay contacts open; On = relay contacts closed.

Note: If 2A2B relay is set to 'Valve Raise', then 3A3B is set to 'Valve Lower'. Similarly, if relay 4AC is set to 'Valve Raise', then relay 5AC is set to 'Valve Lower'.
When the loop channel output is wired to the PV input of a Valve Raise relay, then the PV input of the associated Valve Lower relay becomes unavailable for wiring, and both relays are controlled by the loop as a pair, using only the single wire.

4.7.3 Digital inputs

This applies to terminals pairs LALC, LBLC (figure 2.2).

Type	'Contact I/P'
PV	0 = contact is open; 1 = contact is closed.
Invert	Inverts the sense of the input.

Note... See section B2.6.11 for a description of time proportioning.

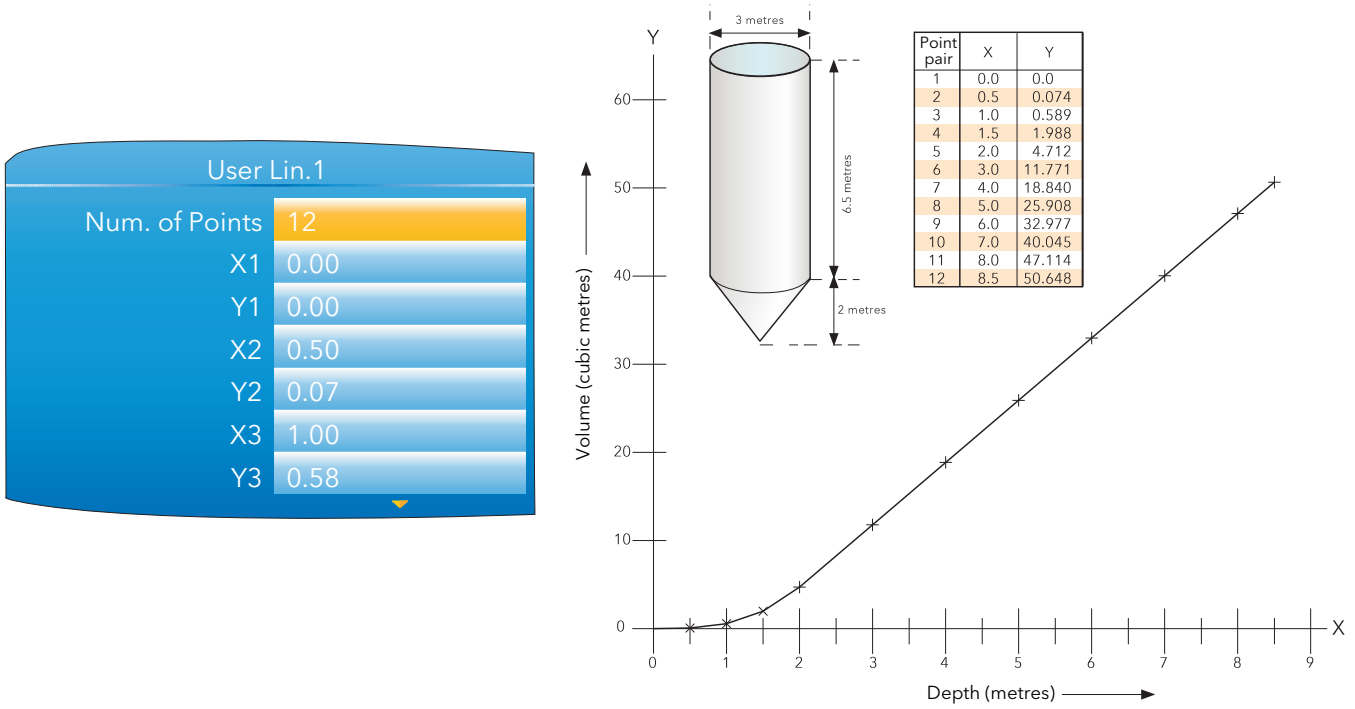
4.8 USER LIN

Allows the entry of up to four user linearisation tables, any one of which can be selected as 'Lin Type' in Channel configuration (section 4.4.1). Configuration consists of defining the number of points to be included (2 to 32) and then entering an X and a Y value for each point, where X values are the inputs and the Y values are the resulting outputs.

4.8.1 User linearisation table rules

1. Tables must be monotonic - i.e. there may not be more than one X value with the same Y value assigned to it.
2 Each X value must be greater than the preceding one.
3. Each Y value must be greater than the preceding one.
4. If units other than temperature units are to be displayed, the channel scale high and scale low values should be set to the same as the range high and low values, and the required scale units entered.

Figure 4.8.1 shows the first part of the configuration table for an imaginary cylinder example.



Point pair	X	Y
1	0.0	0.0
2	0.5	0.074
3	1.0	0.589
4	1.5	1.988
5	2.0	4.712
6	3.0	11.771
7	4.0	18.840
8	5.0	25.908
9	6.0	32.977
10	7.0	40.045
11	8.0	47.114
12	8.5	50.648

Figure 4.8.1 User Linearisation table example

When configuring a channel (section 4.4.1) to use a User linearisation table:

If Type = Thermocouple or RTD, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. The instrument automatically looks up the associated 'X' mV or Ohms values.

If Type = mV, V or mA, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. Input High/Low should be set to the highest and lowest 'X' values in the table, respectively.

4.9 CUSTOM MESSAGES

This feature allows the entry of up to 10 messages for sending to the history file, when triggered by a wired source (e.g. an alarm going active).

The messages of up to 100 characters each are entered using either the virtual keyboard, described in section 3.6, or by means of iTools configuration software.

Up to three parameter values may be embedded in messages in the format [*Address*], where 'Address' is the decimal Modbus address of the parameter (section5.3). E.G. [256] embeds Channel 1 PV.

4.10 ZIRCONIA BLOCK (OPTION)

This option allows the calculation of Carbon Potential, Dew point or Oxygen concentration. A zirconia (oxygen) probe consists of two platinum electrodes bonded to a pellet or cylinder of zirconia. At elevated temperatures, such a probe develops an emf across it which is proportional to the probe absolute temperature and to the log of the difference in oxygen partial pressure between its two ends.

The temperature of the probe is normally measured using a type K or type R thermocouple. The temperature effect on the thermocouple is such, that for successful operation, the probe temperature must be greater than 973K (700°C).

4.10.1 Definitions

TEMPERATURE CONTROL

The sensor input of the temperature loop may come from the zirconia probe but it is common for a separate thermocouple to be used. The controller provides a heating output which may be used to control gas burners. In some applications a cooling output may also be connected to a circulation fan or exhaust damper.

CARBON POTENTIAL CONTROL

The zirconia probe generates a millivolt signal based on the ratio of oxygen concentrations on the reference side of the probe (outside the furnace) to the amount of oxygen in the furnace.

The controller uses the temperature and carbon potential signals to calculate the actual percentage of carbon in the furnace. This second loop generally has two outputs. One output is connected to a valve which controls the amount of an enrichment gas supplied to the furnace. The second output controls the level of dilution air.

SOOTING ALARM

In addition to other alarms which may be detected by the controller, the instrument can trigger an alarm when the atmospheric conditions are such that carbon will be deposited as soot on all surfaces inside the furnace. The alarm may be wired to an output (e.g. relay) to initiate an external alarm.

AUTOMATIC PROBE CLEANING

The instrument has a probe clean and recovery strategy that can be programmed to occur between batches or be manually requested. At the start of the cleaning process a 'snapshot' of the probe mV is taken, and a short blast of compressed air is used to remove any soot and other particles that may have accumulated on the probe. A minimum and maximum cleaning time can be set by the user. If the probe mV has not recovered to within 5% of the snapshot value within the maximum recovery time set then an alarm is given. This indicates that the probe is ageing and replacement or refurbishment is due. During the cleaning and recovery cycle the PV is frozen, thereby ensuring continuous furnace operation. The 'Pv Frozen' parameter can be used in an individual strategy, for example to hold the integral action during cleaning.

ENDOTHERMIC GAS CORRECTION

A gas analyser may be used to determine the carbon monoxide (CO) concentration of the endothermic gas. If a 4 to 20mA output is available from the analyser, this can be applied to the instrument to adjust the calculated % carbon reading automatically. Alternatively, this value can be entered manually.

CLEAN PROBE

As these sensors are used in furnace environments they require regular cleaning. Cleaning (Burn Off) is performed by forcing compressed air through the probe. Cleaning can be initiated either manually or automatically using a timed period. During cleaning 'PV Frozen' is set to 'Yes'.

OXYGEN CONCENTRATION

In order to measure oxygen concentrations, one end of the probe is inserted into the atmosphere to be measured, whilst the other is subjected to a reference atmosphere. For most applications, air provides a suitable reference (reference input = 20.95 for air).

4.10.2 Configuration

The configuration parameters appear in one of three lists as shown in Figure 4.10.2a.

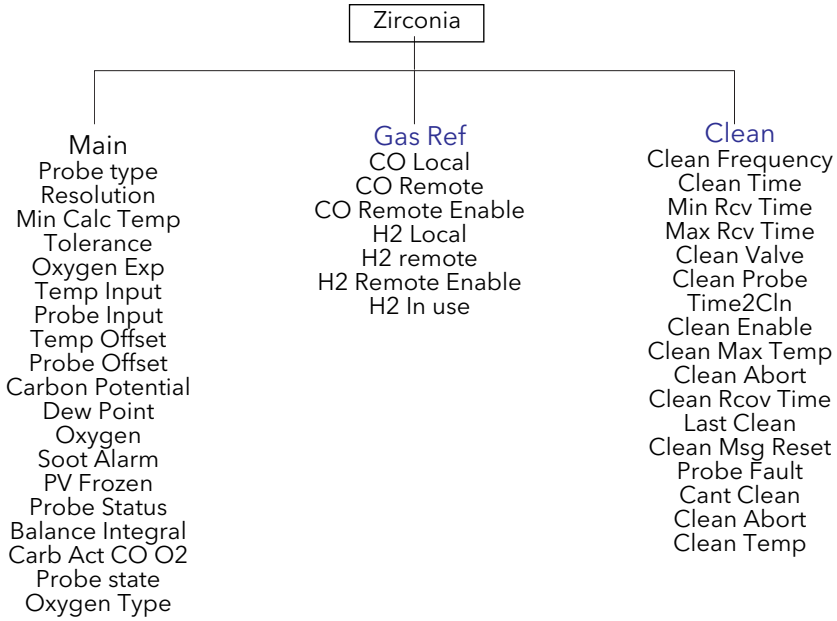


Figure 4.10.2a Zirconia probe configuration layout.

ZIRCONIA MAIN

The parameters that appear depend on the 'Probe Type' setting. For this reason, not all the parameters listed appear for all probe types. Figure 4.10.2b shows a typical configuration page.

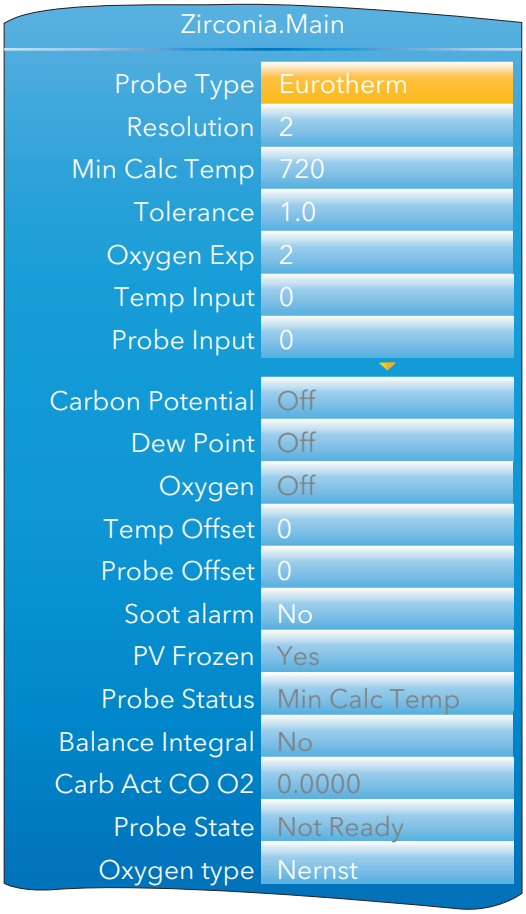


Figure 4.10.2 Zirconia Probe configuration (typical)

4.10.2 CONFIGURATION (Cont.)

MAIN PARAMETERS

Probe Type	Select from a variety of probe manufacturers. The subsequent parameter list depends on which manufacturer is selected.
Resolution	Enter the number of decimal places to be used for the value display
Gas Reference	Reference value for the hydrogen concentration in the atmosphere.
Rem Gas Ref	Remote reference value for hydrogen concentration in the atmosphere. Allows hydrogen concentration to be read from an external source.
Rem Gas Enable	'Yes' allows remote gas measurement. 'No' uses the internal Gas Reference value.
Working Gas	Read only. Working Reference Gas value
Min Calc Temp*	The minimum temperature in at which the calculation is valid.
Oxygen Exp	The exponent units of the log oxygen type calculation. valid entries -24 to +24.
Tolerance	Sooting tolerance multiplier. Allows the user to adjust the sensitivity of the Sooting alarm, in order to reduce the incidence of nuisance alarms.
Process Factor	Process factor defined by the probe manufacturer.
Clean Frequency	Allows the interval between probe cleaning cycles to be entered in hours and minutes.
Clean Time	Allows Probe clean time to be entered in hours and minutes.
Min Rcov Time	The minimum recovery time after purging in hours and minutes.
Max Rcov Time	The maximum recovery time after purging in hours and minutes.
Temp Input*	Zirconia probe temperature input value
Temp Offset*	Allows a temperature offset to be entered for the probe.
Probe Input	Zirconia probe mV input
Probe mV Offset	Allows an offset to be entered for the probe mV input
Oxygen	Read only. calculated oxygen value
Carbon Potential	Read only. The calculated carbon potential.
Dew Point	Read only. The dew point value derived from temperature and remote gas reference inputs.
Soot Alarm	Read only. Sooting alarm. Active if sooting is likely to take place. The sensitivity of the alarm can be adjusted by using the 'Tolerance' parameter, above.
Probe Fault	'Yes' indicates a sensor break.
PV Frozen	Read only. Parameter set to 'Yes' during Probe cleaning.
Clean Valve	Read only. Enable the Clean valve.
Clean State	Read only. The burn off state of the zirconia probe: 'Waiting', 'Cleaning' or 'Recovering'.Clean Probe'Yes' = Initiate probe cleaning. 'No' = Do not clean probe.
Time to Clean	Read only. The time remaining, in hours and minutes until the next cleaning cycle is due.
Probe Status	Read only. Current probe status OK — Normal working mV Sensor Brk — Probe input sensor break Temp Sensor Brk — Temperature input sensor break Min Calc Temp — Probe deteriorating
Balance Integral	This output goes 'true' when a step change in the output occurs, which requires an integral re-balance if the readings are used for PID control.
Carb Act CO O2	The carbon activity for the surface gas reaction between Carbon monoxide (CO) and Oxygen (O2)
Probe State	Read only. The current state of the probe. If 'Measuring', then the outputs are updated. For any other state (Clean, Clean Recovery, Test impedance, Impedance Recovery, Waiting), the outputs are not updated.
OxygenType	Oxygen equation being used.

* Temperature units are those configured for the channel to which the temperature measuring transducer is connected.

4.10.2 CONFIGURATION (Cont.)

GAS REFERENCES PARAMETERS

CO Local	Reference value for the carbon monoxide (CO) concentration in the atmosphere.
CO Remote	Remote reference value for the carbon monoxide concentration in the atmosphere. allows the value to be read remotely.
CO Remote En	'Yes' allows remote CO measurement. 'No' uses the internal value.
CO in Use	The CO gas measurement value currently being used.
H2 Local	Reference value for the hydrogen (H) concentration in the atmosphere.
H2 Remote	Remote reference value for the hydrogen concentration in the atmosphere. allows the value to be read remotely.
H2 Remote En	'Yes' allows remote H measurement. 'No' uses the internal value.
H2 In Use	The H gas measurement value currently being used.

CLEAN PARAMETERS

Clean Frequency	Allows the interval between probe cleaning cycles to be entered in hours and minutes.
Clean Time	Allows Probe clean time to be entered in hours and minutes.
Min Rcov Time	The minimum recovery time after purging in hours and minutes.
Max Rcov time	The maximum recovery time after purging in hours and minutes.
Clean Valve	Read only. Enable the Clean valve.
Clean Probe	Initiate probe cleaning
Time to Clean	Read only. The time remaining, in hours and minutes until the next cleaning cycle is due.
Clean Enable	Enable probe cleaning
Clean Max Temp	Maximum temperature for cleaning. If the temperature exceeds this value, cleaning is aborted.
Clean Abort	Abort probe cleaning
Clean Rcov Time	The time taken for the probe to recover to 95% of its original value after the last clean. If the last clean did not recover within the Max Rcov time, this value is set to 0.
Last Clean	The mV output from the probe after the last clean.
Clean Msg Reset	'Yes' clears cleaning related alarms
Probe Fault	'Yes' means that the probe failed to recover to 95% of its original output, following a clean,
Cant Clean	Conditions exist which prevent a clean cycle starting. Can be cleared using 'Clean Msg Reset'.
Clean Abort	A clean cycle was aborted. Can be cleared using 'Clean Msg Reset'.
Clean Temp	A clean cycle was aborted because the temperature was too high. Can be cleared using 'Clean Msg Reset'.

4.10.3 Wiring

Figure 4.10.3 shows a typical wiring arrangement for a Zirconia probe.

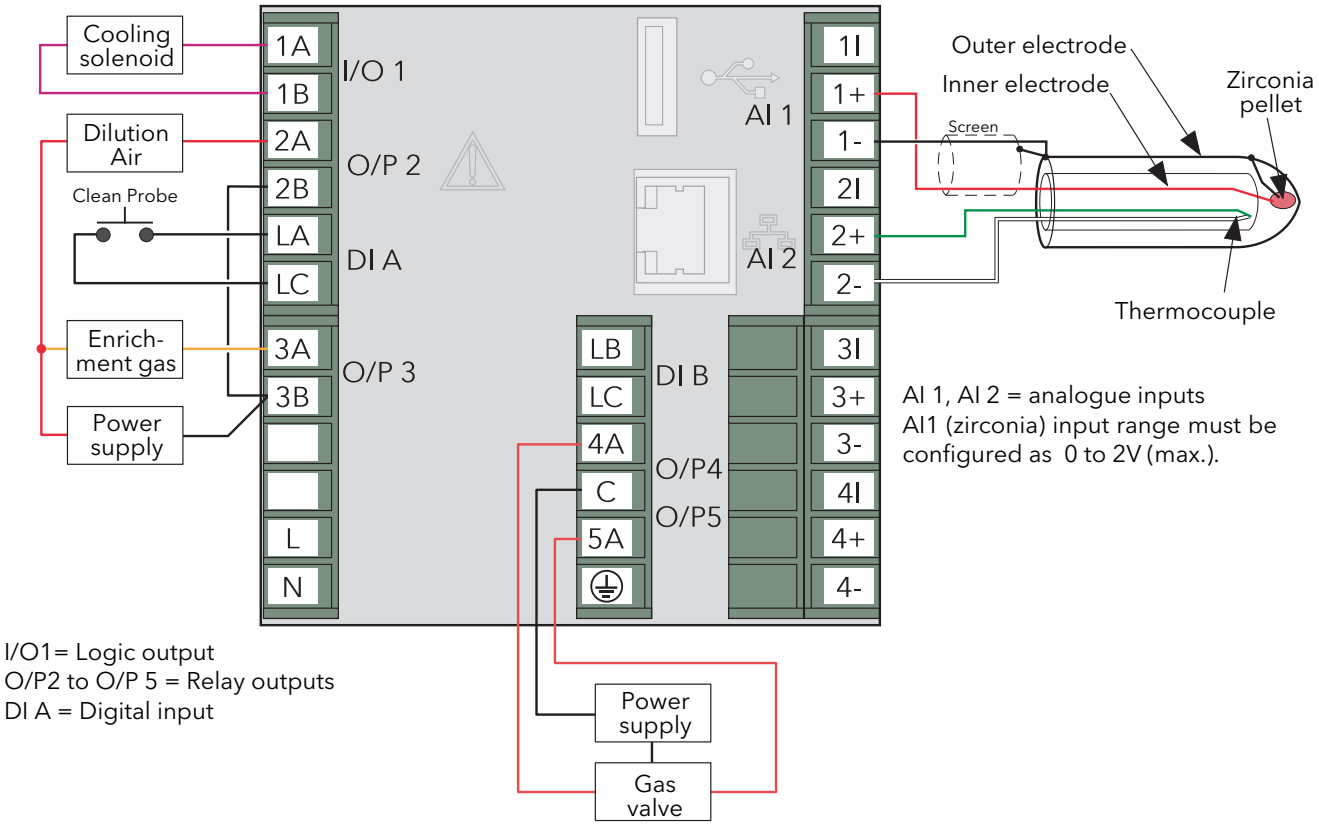


Figure 4.10.3 Typical zirconia probe wiring

4.11 ALARM SUMMARY

Allows the user to view the overall status of the unit's alarms, and to carry out a global acknowledgement of active alarms if required.

Global Ack	Allows the user to acknowledge all applicable alarms simultaneously. 'Manual' alarms must be non-active before they can be acknowledged.
Any Channel alarm	Indicates if there are any channel alarms active, acknowledged etc.
Any Sys Alarm	Indicates if there are any active system alarms.
Any Alarm	Indicates if there are any channel or system alarms active.

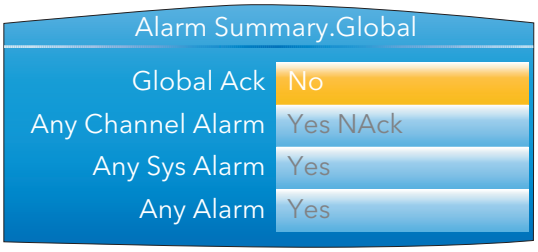


Figure 4.11 Alarm summary display

5 MODBUS TCP SLAVE COMMS

5.1 INSTALLATION

The installation of the Modbus link consists of connecting a standard Ethernet cable between the RJ45 connector at the rear of the unit to a host computer either directly or via a network. A 'straight-through' cable can be used in either case (i.e. a cross-over cable is not required).

5.2 INTRODUCTION

MODBUS TCP allows the instrument to act as a 'slave' device to one or more host computers connected via the RJ45 connector at the rear of the recorder. Each recorder must have a unique Internet Protocol (IP) address, set up as described in Section 4.2.1 (Network.Interface).

MODBUS TCP (Transmission Control Protocol) is a variant of the MODBUS family of communications protocols intended for supervision and control of automated equipment specifically covering the use of MODBUS messaging in an intranet or internet environment, using TCP/IP protocols. Much of the MODBUS detail in this manual is derived from the document openmbus.doc, available at http://www.modbus.org/default.htm The above mentioned document also includes implementation guidelines for users.

Note: The Modbus protocol allows a maximum of 255 data bytes to be read from or written to in one transaction. For this reason, the maximum number of standard (16 bit) registers that can be accessed in one transaction is 255/2 = 127 and the maximum number of IEEE (32-bit) registers is 127/2 = 63.

5.2.1 Function Codes

MODBUS function codes 3, 4, 6, 8 and 16, defined in table 8.2.1a below, are supported and are fully described in section 5.5, below.

Code	Modbus definition	Description
03	Read holding registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
04	Read input registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
06	Preset single register	Writes a single value to a single register.
08	Diagnostics	Performs a simple loop back test.
16	Preset multiple registers	Writes values to multiple holding registers.

Table 5.2.1a MODBUS Function code definition

DIAGNOSTIC CODES

Function code 08, subfunction 00 (Return query data) echoes the query (Loop back).

5.2.1 FUNCTION CODES (Cont.)

EXCEPTION CODES

MODBUS TCP provides reserved codes used for exceptions. These codes provide error information relating to failed requests. Exceptions are signalled by hex 80 being added to the function code of the request, followed by one of the codes listed in table 8.2.1b, below.

Code		Modbus definition	Description (see Modbus specification for full details)
Dec	Hex		
01	01	Illegal function	An invalid function code was received
02	02	Illegal Data Address	An invalid data address was received
03	03	Illegal Data Value	An invalid data value was received
04	04	Slave Device Failure	An unrecoverable error occurred in the recorder
09	09	Illegal Sub Function	An invalid sub function was received
10	0A	Gateway path unavailable	Gateway misconfigured or overloaded
11	0B	Gateway target device failed to respond	Device not present on the network

Table 5.2.1b Exception codes

5.2.2 Data types

The following data types are supported:

1. 2's complement signed 16-bit analogue values with implied decimal point. The decimal point position must be configured in both the recorder and the host computer.
2. 16, 32 and 64 bit signed integers.
3. 16-bit unsigned integer values.
4. 32 bit IEEE Floating point values.
5. Strings of limited size, can be transferred across Modbus TCP in Unicode format using a single non-multiplexed set of consecutive registers.

DATA ENCODING

MODBUS uses what is called a 'Big endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first. For example a 32-bit hex value of 12345678 would be transmitted as 12, followed by 34, followed by 56 and finally 78.

5.2.3 Invalid multiple register writes

When a recorder receives a multi-register write request, it is possible that one or more requests will be rejected. Under such a circumstance, the recorder accepts all valid write requests and ignores any invalid writes. No error response is produced.

5.2.4 Master communications timeout

Whilst the instrument is archiving, it is possible that communications responses slow sufficiently to cause communications timouts. The Modbus master device should be configured with a timout value large enough to ensure against nuisance timeouts during archiving.

5.2.4 Non-volatile parameters in EEPROM

CAUTION

The parameters in the following list must not be written-to on a continuous basis as to do so will damage the EEPROM, greatly shortening its useful life.

Note: 'nvol' = 'non-volatile'. Loop 'N' = Loop1 and Loop2; Channel 'N' = Channel 1, 2, 3 and 4 etc.

Channel.N.AlarmN.Amount	Group.Trend.Interval
Channel.N.AlarmN.Average Time	Group.Trend.Major Divs
Channel.N.AlarmN.Block	Group.Trend.PointN
Channel.N.AlarmN.Change Time	Instrument.Display.Brightness
Channel.N.AlarmN.Deviation	Instrument.Display.Dual Loop
Channel.N.AlarmN.Dwell	Instrument.Display.H.Trend scaling
Channel.N.AlarmN.Hysteresis	Instrument.Display.Home Page
Channel.N.AlarmN.Latch	Instrument.Display.Horizontal Bar
Channel.N.AlarmN.Threshold	Instrument.Display.Horizontal Trend
Channel.N.AlarmN.Type	Instrument.Display.HPage Timeout
Channel.N.Main.Break Response	Instrument.Display.Loop control
Channel.N.Main.CJ Type	Instrument.Display.Numeric
Channel.N.Main.Descriptor	Instrument.Display.Promote List
Channel.N.Main.Ext CJ Temp	Instrument.Display.Save After
Channel.N.Main.Filter	Instrument.Display.Saver Brightness
Channel.N.Main.Input High	Instrument.Display.Setpoint colour
Channel.N.Main.Input Low	Instrument.Display.Trend Backgrnd
Channel.N.Main.Lin Type	Instrument.Display.Vertical Bar
Channel.N.Main.Offset	Instrument.Display.Vertical Trend
Channel.N.Main.Range High	Instrument.Info.Name
Channel.N.Main.Range Low	Instrument.Locale.Date Format
Channel.N.Main.Range Units	Instrument.Locale.DST Enable
Channel.N.Main.Resolution	Instrument.Locale.End Day
Channel.N.Main.Scale High	Instrument.Locale.End Month
Channel.N.Main.Scale Low	Instrument.Locale.End On
Channel.N.Main.Sensor Break Type	Instrument.Locale.End Time
Channel.N.Main.Shunt	Instrument.Locale.Start Day
Channel.N.Main.Test Signal	Instrument.Locale.Start Month
Channel.N.Main.Type	Instrument.Locale.Start On
Channel.N.Main.Units	Instrument.Locale.Start Time
Channel.N.Trend.Colour	Instrument.Locale.Time Zone
Channel.N.Trend.Span High	Instrument.Notes.NoteN
Channel.N.Trend.Span Low	Instrument.Promote List Param N
Custom Message..MessageN	Instrument.Promote List Param N Desc
Digital I/O.1A1B (Dig.IO)..Invert	Instrument.Security.Comms Pass
Digital I/O.1A1B (Dig.IO)..Min On Time	Instrument.Security.Default Config.
Digital I/O.1A1B (Dig.IO)..Type	Instrument.Security.Engineer Pass
Digital I/O.2A2B (Relay)..Invert	Instrument.Security.Operator Pass
Digital I/O.2A2B (Relay)..Min On Time	Instrument.Security.Supervisor Pass
Digital I/O.2A2B (Relay)..Type	Instrument.Upgrade.Account Password
Digital I/O.3A3B (Relay)..Invert	Instrument.Upgrade.Account Username
Digital I/O.3A3B (Relay)..Min On Time	Instrument.Upgrade.Server IP Address
Digital I/O.3A3B (Relay)..Type	Instrument.Upgrade.Source Path
Digital I/O.4AC (Relay)..Invert	Instrument.Upgrade.Upgrade
Digital I/O.4AC (Relay)..Min On Time	Loop.N.Diagnostics.Loop Mode
Digital I/O.4AC (Relay)..Type	Loop.N.Output.Ch2 Deadband
Digital I/O.5AC (Relay)..Invert	Loop.N.Output.ChN OnOff Hyst
Digital I/O.5AC (Relay)..Min On Time	Loop.N.Output.ChN Travel Time
Digital I/O.5AC (Relay)..Type	Loop.N.Output.Cool Type
Digital I/O.LALC (Dig.In)..Invert	Loop.N.Output.FF Gain
Digital I/O.LALC (Dig.In)..Min On Time	Loop.N.Output.FF Offset
Digital I/O.LALC (Dig.In)..Type	Loop.N.Output.FF Trim Lim
Digital I/O.LBLC (Dig.In)..Invert	Loop.N.Output.FF Type
Digital I/O.LBLC (Dig.In)..Min On Time	Loop.N.Output.Manual Mode
Digital I/O.LBLC (Dig.In)..Type	Loop.N.Output.Manual Startup
Group.Recording.ChannelN	Loop.N.Output.Output High
Group.Recording.Enable	Loop.N.Output.Output Low
Group.Recording.Interval	Loop.N.Output.Pff En
Group.Recording.UHH Compression	Loop.N.Output.Pot Brk Mode
Group.Recording.VirtualChanN	Loop.N.Output.Rate
Group.Trend.Descriptor	Loop.N.Output.Rate Disable

5.2.4 NON-VOLATILE PARAMETERS IN EEPROM (Cont.)

Loop.N.Output.Safe OP
Loop.N.Output.Sbrk Mode
Loop.N.Output.Sbrk OP
Loop.N.PID.Boundary 1-2
Loop.N.PID.Boundary 2-3
Loop.N.PID.CBH
Loop.N.PID.CBH2
Loop.N.PID.CBH3
Loop.N.PID.CBL
Loop.N.PID.CBL2
Loop.N.PID.CBL3
Loop.N.PID.LBT
Loop.N.PID.LBT2
Loop.N.PID.LBT3
Loop.N.PID.MR
Loop.N.PID.MR2
Loop.N.PID.MR3
Loop.N.PID.Number of Sets
Loop.N.PID.PB
Loop.N.PID.PB2
Loop.N.PID.PB3
Loop.N.PID.R2G
Loop.N.PID.R2G2
Loop.N.PID.R2G3
Loop.N.PID.Remote Input
Loop.N.PID.Sched Type
Loop.N.PID.Td
Loop.N.PID.Td2
Loop.N.PID.Td3
Loop.N.PID.Ti
Loop.N.PID.Ti2
Loop.N.PID.Ti3
Loop.N.Setpoint.Manual Track
Loop.N.Setpoint.Range High
Loop.N.Setpoint.Range Low
Loop.N.Setpoint.Servo To PV
Loop.N.Setpoint.Setpoint Track
Loop.N.Setpoint.SP High Limit
Loop.N.Setpoint.SP Low Limit
Loop.N.Setpoint.SP Trim High
Loop.N.Setpoint.SP Trim Low
Loop.N.Setup.Auto/Man Access
Loop.N.Setup.ChN Control
Loop.N.Setup.Control Action
Loop.N.Setup.Deriv. Type
Loop.N.Setup.Loop Name
Loop.N.Setup.PB Units
Loop.N.Setup.Setpoint Access
Loop.N.Tune.AT.R2G
Loop.N.Tune.High Output
Loop.N.Tune.Low Output
Loop.N.Tune.Type
Network.Archiving.CSV Date Format
Network.Archiving.CSV Headers
Network.Archiving.CSV Headings
Network.Archiving.CSV Messages
Network.Archiving.CSV Tab Del
Network.Archiving.CSV Values
Network.Archiving.Destination
Network.Archiving.File Format
Network.Archiving.On Media Full
Network.Archiving.Period
Network.Archiving.Primary Password
Network.Archiving.Primary Server
Network.Archiving.Primary User
Network.Archiving.Rate
Network.Archiving.Remote Path
Network.Archiving.Sec. Password
Network.Archiving.Sec. Server
Network.Archiving.Sec. User
Network.FTP Server.Password
Network.FTP Server.Username
Network.Interface.DNS Server
Network.Interface.Gateway
Network.Interface.IP Address
Network.Interface.IP Type
Network.Interface.Subnet Mask
Network.Modbus.Address
Network.Modbus.Input Timeout
Network.Modbus.PrefMaster IP
Network.Modbus.Serial Mode
Network.Modbus.Time Format
Network.Modbus.Unit ID Enable
User Lin.N..Num. Of Points
User Lin.N..Xn
User Lin.N..Yn
Virtual Channel.N.AlarmN.Amount
Virtual Channel.N.AlarmN.Average Time
Virtual Channel.N.AlarmN.Block
Virtual Channel.N.AlarmN.Change Time
Virtual Channel.N.AlarmN.Deviation
Virtual Channel.N.AlarmN.Dwell
Virtual Channel.N.AlarmN.Hysteresis
Virtual Channel.N.AlarmN.Latch
Virtual Channel.N.AlarmN.Threshold
Virtual Channel.N.AlarmN.Type
Virtual Channel.N.Main.Descriptor
Virtual Channel.N.Main.High Cut Off
Virtual Channel.N.Main.Low Cut Off
Virtual Channel.N.Main.Operation
Virtual Channel.N.Main.Period
Virtual Channel.N.Main.Preset Value
Virtual Channel.N.Main.Resolution
Virtual Channel.N.Main.Type
Virtual Channel.N.Main.Units
Virtual Channel.N.Main.Units Scaler
Virtual Channel.N.Trend.Colour
Virtual Channel.N.Trend.Span High
Virtual Channel.N.Trend.Span Low
Zirconia.Clean.Clean Enable
Zirconia.Clean.Clean Frequency
Zirconia.Clean.Clean Max Temp
Zirconia.Clean.Clean Time
Zirconia.Clean.Max Rcov Time
Zirconia.Clean.Min Rcov Time
Zirconia.Gas References.CO Ideal
Zirconia.Gas References.CO Local
Zirconia.Gas References.CO Remote En
Zirconia.Gas References.H2 Local
Zirconia.Gas References.H2 Remote En
Zirconia.Main.Clean Frequency
Zirconia.Main.Clean Time
Zirconia.Main.Gas Reference
Zirconia.Main.Max Rcov Time
Zirconia.Main.Min Calc Temp
Zirconia.Main.Min Rcov Time
Zirconia.Main.Oxygen Exp
Zirconia.Main.Oxygen Type
Zirconia.Main.Probe Offset
Zirconia.Main.Probe Type
Zirconia.Main.Process Factor
Zirconia.Main.Rem Gas Enable
Zirconia.Main.Resol'n
Zirconia.Main.Resolution
Zirconia.Main.Temp Offset
Zirconia.Main.Tolerence

5.3 PARAMETER LIST

This list is arranged in alphabetical block order and gives the memory address for each parameter in both hex and decimal.

The blocks are as follows:

Alarm summary	Instrument	User Lin 4	Virtual chan 8
Channel 1	Loop 1	Virtual chan 1	Virtual chan 9
Channel 2	Loop 2	Virtual chan 2	Virtual chan 10
Channel 3	Network	Virtual chan 3	Virtual chan 11
Channel 4	OR block	Virtual chan 4	Virtual chan 12
Custom messages	User Lin 1	Virtual chan 5	Virtual chan 13
Digital I/O	User Lin 2	Virtual chan 6	Virtual chan 14
Group	User Lin 3	Virtual chan 7	Zirconia

DIGITAL I/O ASSIGNMENTS

There are seven DIO instances, each of which is associated with a particular set of terminals at the rear of the instrument (figure 2.2), as follows:

DIO 1 is the digital I/O associated with terminals 1A1B
DIO 2 is the relay associated with terminals 2A2B
DIO 3 is the digital input associated with terminals LALC
DIO 4 is the relay associated with terminals 3A3B
DIO 5 is the digital input associated with terminals LBLC
DIO 6 is the relay associated with terminals 4AC
DIO 7 is the relay associated with terminals 5AC

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
AlarmSummary.AnyAlarm	0 = No active alarms; 1 = one or more alarms active	bool	01a2	418	Not applicable
AlarmSummary.AnyChanAlarm	0 = No channel alarms 1 = Channel alarm(s) active but all ack'd. 2 = Channel alarm(s) active but not all ack'd	uint8	01a0	416	Not applicable
AlarmSummary.AnySystemAlarm	0 = No system alarms; 1 = 1 or more system alm(s)	bool	01a1	417	Not applicable
AlarmSummary.Channel.Alarm1Ack	Acknowledge the most recent channel alarm	bool	1192	4498	Not applicable
AlarmSummary.Channel.Alarm1Num	Channel and alarm number of most recent alarm 0 = No alarm 4 = Ch1;Al1 5 =Ch1;Al2 8 = Ch2;Al1 9 = Ch2Al2 12 = Ch3;Al1 13 = Ch3;Al2 16 = Ch4;Al1 17 = Ch4;Al2 132 = VC1;Al1 133 = VC1;Al2 136 = VC2;Al1 137 = VC2;Al2 140 = VC3;Al1 141 = VC3;Al2 144 = VC4;Al1 145 = VC4;Al2 148 = VC5;Al1 149 = VC5;Al2 152 = VC6;Al1 153 = VC6;Al2 156 = VC7;Al1 157 = VC7;Al2 160 = VC8;Al1 161 = VC8;Al2 164 = VC9;Al1 165 = VC9;Al2 168 = VC10;Al1 169 = VC10;Al2 172 = VC11;Al1 173 = VC11;Al2 176 = VC12;Al1 177 = VC12;Al2 180 = VC13;Al1 181 = VC13;Al2 184 = VC14Al1 185 = VC14;Al2	uint8	1190	4496	Not applicable
AlarmSummary.Channel.Alarm1Status	Status of most recent alarm 0 = Off 1 = Active 2 = Safe unack 3 = Active unack	uint8	1191	4497	Not applicable
AlarmSummary.Channel.Alarm2Ack	Acknowledge the 2nd most recent channel alarm	bool	1195	4501	Not applicable
AlarmSummary.Channel.Alarm2Num	As Alarm1Num, but for 2nd most recent alarm	uint8	1193	4499	Not applicable
AlarmSummary.Channel.Alarm2Status	As Alarm1Status, but for 2nd most recent alarm	uint8	1194	4500	Not applicable
AlarmSummary.Channel.Alarm3Ack	Acknowledge the 3rd most recent channel alarm	bool	1198	4504	Not applicable
AlarmSummary.Channel.Alarm3Num	As Alarm1Num, but for 3rd most recent alarm	uint8	1196	4502	Not applicable
AlarmSummary.Channel.Alarm3Status	As Alarm1Status, but for 3rd most recent alarm	uint8	1197	4503	Not applicable
AlarmSummary.Channel.Alarm4Ack	Acknowledge the 4th most recent channel alarm	bool	119b	4507	Not applicable
AlarmSummary.Channel.Alarm4Num	As Alarm1Num, but for 4th most recent alarm	uint8	1199	4505	Not applicable
AlarmSummary.Channel.Alarm4Status	As Alarm1Status, but for 4th most recent alarm	uint8	119a	4506	Not applicable
AlarmSummary.Channel.Alarm5Ack	Acknowledge the 5th most recent channel alarm	bool	119e	4510	Not applicable
AlarmSummary.Channel.Alarm5Num	As Alarm1Num, but for 5th most recent alarm	uint8	119c	4508	Not applicable
AlarmSummary.Channel.Alarm5Status	As Alarm1Status, but for 5th most recent alarm	uint8	119d	4509	Not applicable
AlarmSummary.Channel.Alarm6Ack	Acknowledge the 6th most recent channel alarm	bool	11a1	4513	Not applicable
AlarmSummary.Channel.Alarm6Num	As Alarm1Num, but for 6th most recent alarm	uint8	119f	4511	Not applicable
AlarmSummary.Channel.Alarm6Status	As Alarm1Status, but for 6th most recent alarm	uint8	11a0	4512	Not applicable
AlarmSummary.Channel.Alarm7Ack	Acknowledge the 7th most recent channel alarm	bool	11a4	4516	Not applicable
AlarmSummary.Channel.Alarm7Num	As Alarm1Num, but for 7th most recent alarm	uint8	11a2	4514	Not applicable
AlarmSummary.Channel.Alarm7Status	As Alarm1Status, but for 7th most recent alarm	uint8	11a3	4515	Not applicable
AlarmSummary.Channel.Alarm8Ack	Acknowledge the 8th most recent channel alarm	bool	11a7	4519	Not applicable
AlarmSummary.Channel.Alarm8Num	As Alarm1Num, but for 8th most recent alarm	uint8	11a5	4517	Not applicable
AlarmSummary.Channel.Alarm8Status	As Alarm1Status, but for 8th most recent alarm	uint8	11a6	4518	Not applicable
AlarmSummary.Channel.Alarm9Ack	Acknowledge the 9th most recent channel alarm	bool	11aa	4522	Not applicable
AlarmSummary.Channel.Alarm9Num	As Alarm1Num, but for 9th most recent alarm	uint8	11a8	4520	Not applicable
AlarmSummary.Channel.Alarm9Status	As Alarm1Status, but for 9th most recent alarm	uint8	11a9	4521	Not applicable
AlarmSummary.Channel.Alarm10Ack	Acknowledge the 10th most recent channel alarm	bool	11ad	4525	Not applicable
AlarmSummary.Channel.Alarm10Num	As Alarm1Num, but for 10th most recent alarm	uint8	11ab	4523	Not applicable
AlarmSummary.Channel.Alarm10Status	As Alarm1Status, but for 10th most recent alarm	uint8	11ac	4524	Not applicable
AlarmSummary.Channel.Alarm11Ack	Acknowledge the 11th most recent channel alarm	bool	11b0	4528	Not applicable
AlarmSummary.Channel.Alarm11Num	As Alarm1Num, but for 11th most recent alarm	uint8	11ae	4526	Not applicable
AlarmSummary.Channel.Alarm11Status	As Alarm1Status, but for 11th most recent alarm	uint8	11af	4527	Not applicable
AlarmSummary.Channel.Alarm12Ack	Acknowledge the 12th most recent channel alarm	bool	11b3	4531	Not applicable
AlarmSummary.Channel.Alarm12Num	As Alarm1Num, but for 12th most recent alarm	uint8	11b1	4529	Not applicable
AlarmSummary.Channel.Alarm12Status	As Alarm1Status, but for 12th most recent alarm	uint8	11b2	4530	Not applicable
AlarmSummary.Channel.Alarm13Ack	Acknowledge the 13th most recent channel alarm	bool	11b6	4534	Not applicable
AlarmSummary.Channel.Alarm13Num	As Alarm1Num, but for 13th most recent alarmr	uint8	11b4	4532	Not applicable
AlarmSummary.Channel.Alarm13Status	As Alarm1Status, but for 13th most recent alarm	uint8	11b5	4533	Not applicable
AlarmSummary.Channel.Alarm14Ack	Acknowledge the 14th most recent channel alarm	bool	11b9	4537	Not applicable
AlarmSummary.Channel.Alarm14Num	As Alarm1Num, but for 14th most recent alarmr	uint8	11b7	4535	Not applicable
AlarmSummary.Channel.Alarm14Status	As Alarm1Status, but for 14th most recent alarm	uint8	11b8	4536	Not applicable
AlarmSummary.Channel.Alarm15Ack	Acknowledge the 15th most recent channel alarm	bool	11bc	4540	Not applicable
AlarmSummary.Channel.Alarm15Num	As Alarm1Num, but for 15th most recent alarm	uint8	11ba	4538	Not applicable
AlarmSummary.Channel.Alarm15Status	As Alarm1Status, but for 15th most recent alarm	uint8	11bb	4539	Not applicable
AlarmSummary.Channel.Alarm16Ack	Acknowledge the 16th most recent channel alarm	bool	11bf	4543	Not applicable
AlarmSummary.Channel.Alarm16Num	As Alarm1Num, but for 16th most recent alarm	uint8	11bd	4541	Not applicable
AlarmSummary.Channel.Alarm16Status	As Alarm1Status, but for 16th most recent alarm	uint8	11be	4542	Not applicable
AlarmSummary.Channel.Alarm17Ack	Acknowledge the 17th most recent channel alarm	bool	11c2	4546	Not applicable
AlarmSummary.Channel.Alarm17Num	As Alarm1Num, but for 17th most recent alarm	uint8	11c0	4544	Not applicable
AlarmSummary.Channel.Alarm17Status	As Alarm1Status, but for 17th most recent alarm	uint8	11c1	4545	Not applicable
AlarmSummary.Channel.Alarm18Ack	Acknowledge the 18th most recent channel alarm	bool	11c5	4549	Not applicable
AlarmSummary.Channel.Alarm18Num	As Alarm1Num, but for 18th most recent alarm	uint8	11c3	4547	Not applicable
AlarmSummary.Channel.Alarm18Status	As Alarm1Status, but for 18th most recent alarm	uint8	11c4	4548	Not applicable
AlarmSummary.Channel.Alarm19Ack	Acknowledge the 19th most recent channel alarm	bool	11c8	4552	Not applicable
AlarmSummary.Channel.Alarm19Num	As Alarm1Num, but for 19th most recent alarm	uint8	11c6	4550	Not applicable
AlarmSummary.Channel.Alarm19Status	As Alarm1Status, but for 19th most recent alarm	uint8	11c7	4551	Not applicable
AlarmSummary.Channel.Alarm20Ack	Acknowledge the 20th most recent channel alarm	bool	11cb	4555	Not applicable
AlarmSummary.Channel.Alarm20Num	As Alarm1Num, but for 20th most recent alarm	uint8	11c9	4553	Not applicable
AlarmSummary.Channel.Alarm20Status	As Alarm1Status, but for 20th most recent alarm	uint8	11ca	4554	Not applicable
AlarmSummary.Channel.Alarm21Ack	Acknowledge the 21st most recent channel alarm	bool	11ce	4558	Not applicable
AlarmSummary.Channel.Alarm21Num	As Alarm1Num, but for 21st most recent alarm	uint8	11cc	4556	Not applicable
AlarmSummary.Channel.Alarm21Status	As Alarm1Status, but for 21st most recent alarm	uint8	11cd	4557	Not applicable
AlarmSummary.Channel.Alarm22Ack	Acknowledge the 22nd most recent channel alarm	bool	11d1	4561	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
AlarmSummary.Channel.Alarm22Num	As Alarm1Num, but for 22nd most recent alarm	uint8	11cf	4559	Not applicable
AlarmSummary.Channel.Alarm22Status	As Alarm1Status, but for 22nd most recent alarm	uint8	11d0	4560	Not applicable
AlarmSummary.Channel.Alarm23Ack	Acknowledge the 23rd most recent channel alarm	bool	11d4	4564	Not applicable
AlarmSummary.Channel.Alarm23Num	As Alarm1Num, but for 23th most recent alarm	uint8	11d2	4562	Not applicable
AlarmSummary.Channel.Alarm23Status	As Alarm1Status, but for 23rd most recent alarm	uint8	11d3	4563	Not applicable
AlarmSummary.Channel.Alarm24Ack	Acknowledge the 24th most recent channel alarm	bool	11d7	4567	Not applicable
AlarmSummary.Channel.Alarm24Num	As Alarm1Num, but for 24th most recent alarm	uint8	11d5	4565	Not applicable
AlarmSummary.Channel.Alarm24Status	As Alarm1Status, but for 24th most recent alarm	uint8	11d6	4566	Not applicable
AlarmSummary.Channel.Alarm25Ack	Acknowledge the 25th most recent channel alarm	bool	11da	4570	Not applicable
AlarmSummary.Channel.Alarm25Num	As Alarm1Num, but for 25th most recent alarm	uint8	11d8	4568	Not applicable
AlarmSummary.Channel.Alarm25Status	As Alarm1Status, but for 25th most recent alarm	uint8	11d9	4569	Not applicable
AlarmSummary.Channel.Alarm26Ack	Acknowledge the 26th most recent channel alarm	bool	11dd	4573	Not applicable
AlarmSummary.Channel.Alarm26Num	As Alarm1Num, but for 26th most recent alarm	uint8	11db	4571	Not applicable
AlarmSummary.Channel.Alarm26Status	As Alarm1Status, but for 26th most recent alarm	uint8	11dc	4572	Not applicable
AlarmSummary.Channel.Alarm27Ack	Acknowledge the 27th most recent channel alarm	bool	11e0	4576	Not applicable
AlarmSummary.Channel.Alarm27Num	As Alarm1Num, but for 27th most recent alarm	uint8	11de	4574	Not applicable
AlarmSummary.Channel.Alarm27Status	As Alarm1Status, but for 27th most recent alarm	uint8	11df	4575	Not applicable
AlarmSummary.Channel.Alarm28Ack	Acknowledge the 28th most recent channel alarm	bool	11e3	4579	Not applicable
AlarmSummary.Channel.Alarm28Num	As Alarm1Num, but for 28th most recent alarm	uint8	11e1	4577	Not applicable
AlarmSummary.Channel.Alarm28Status	As Alarm1Status, but for 28th most recent alarm	uint8	11e2	4578	Not applicable
AlarmSummary.Channel.Alarm29Ack	Acknowledge the 29th most recent channel alarm	bool	11e6	4582	Not applicable
AlarmSummary.Channel.Alarm29Num	As Alarm1Num, but for 29th most recent alarm	uint8	11e4	4580	Not applicable
AlarmSummary.Channel.Alarm29Status	As Alarm1Status, but for 29th most recent alarm	uint8	11e5	4581	Not applicable
AlarmSummary.Channel.Alarm30Ack	Acknowledge the 30th most recent channel alarm	bool	11e9	4585	Not applicable
AlarmSummary.Channel.Alarm30Num	As Alarm1Num, but for 30th most recent alarm	uint8	11e7	4583	Not applicable
AlarmSummary.Channel.Alarm30Status	As Alarm1Status, but for 30th most recent alarm	uint8	11e8	4584	Not applicable
AlarmSummary.Channel.Alarm31Ack	Acknowledge the 31st most recent channel alarm	bool	11ec	4588	Not applicable
AlarmSummary.Channel.Alarm31Num	As Alarm1Num, but for 31st most recent alarm	uint8	11ea	4586	Not applicable
AlarmSummary.Channel.Alarm31Status	As Alarm1Status, but for 31st most recent alarm	uint8	11eb	4587	Not applicable
AlarmSummary.Channel.Alarm32Ack	Acknowledge the 32nd most recent channel alarm	bool	11ef	4591	Not applicable
AlarmSummary.Channel.Alarm32Num	As Alarm1Num, but for 32nd most recent alarm	uint8	11ed	4589	Not applicable
AlarmSummary.Channel.Alarm32Status	As Alarm1Status, but for 32nd most recent alarm	uint8	11ee	4590	Not applicable
AlarmSummary.Channel.Alarm33Ack	Acknowledge the 33rd most recent channel alarm	bool	11f2	4594	Not applicable
AlarmSummary.Channel.Alarm33Num	As Alarm1Num, but for 33rd most recent alarm	uint8	11f0	4592	Not applicable
AlarmSummary.Channel.Alarm33Status	As Alarm1Status, but for 33rd most recent alarm	uint8	11f1	4593	Not applicable
AlarmSummary.Channel.Alarm34Ack	Acknowledge the 34th most recent channel alarm	bool	11f5	4597	Not applicable
AlarmSummary.Channel.Alarm34Num	As Alarm1Num, but for 34th most recent alarm	uint8	11f3	4595	Not applicable
AlarmSummary.Channel.Alarm34Status	As Alarm1Status, but for 34th most recent alarm	uint8	11f4	4596	Not applicable
AlarmSummary.Channel.Alarm35Ack	Acknowledge the 35th most recent channel alarm	bool	11f8	4600	Not applicable
AlarmSummary.Channel.Alarm35Num	As Alarm1Num, but for 35th most recent alarm	uint8	11f6	4598	Not applicable
AlarmSummary.Channel.Alarm35Status	As Alarm1Status, but for 35th most recent alarm	uint8	11f7	4599	Not applicable
AlarmSummary.Channel.Alarm36Ack	Acknowledge the 36th most recent channel alarm	bool	11fb	4603	Not applicable
AlarmSummary.Channel.Alarm36Num	As Alarm1Num, but for 36th most recent alarm	uint8	11f9	4601	Not applicable
AlarmSummary.Channel.Alarm36Status	As Alarm1Status, but for 36th most recent alarm	uint8	11fa	4602	Not applicable
AlarmSummary.GlobalAck	Acknowledge all alarms. 0=No;1 = yes	bool	01a3	419	Not applicable
AlarmSummary.StatusWord1	A summary of Channel 1-4 alarms Bit 0: 1 = Channel 1 Alarm 1 active Bit 1: 1 = Channel 1 Alarm 1 not acknowledged Bit 2: 1 = Channel 1 Alarm 2 active Bit 3: 1 = Channel 1 Alarm 2 not acknowledged Bit 4: 1 = Channel 2 Alarm 1 active Bit 5: 1 = Channel 2 Alarm 1 not acknowledged Bit 6: 1 = Channel 2 Alarm 2 active Bit 7: 1 = Channel 2 Alarm 2 not acknowledged Bit 8: 1 = Channel 3 Alarm 1 active Bit 9: 1 = Channel 3 Alarm 1 not acknowledged Bit 10: 1 = Channel 3 Alarm 2 active Bit 11: 1 = Channel 3 Alarm 2 not acknowledged Bit 12: 1 = Channel 4 Alarm 1 active Bit 13: 1 = Channel 4 Alarm 1 not acknowledged Bit 14: 1 = Channel 4 Alarm 2 active Bit 15: 1 = Channel 4 Alarm 2 not acknowledged	int16	01a4	420	Not applicable
AlarmSummary.StatusWord2	A summary of Virtual Channel 1 to 4 alarms Bit 0: 1 = Virtual channel 1 Alarm 1 active Bit 1: 1 = Virtual channel 1 Alarm 1 not ack'd Bit 2: 1 = Virtual channel 1 Alarm 2 active Bit 3: 1 = Virtual channel 1 Alarm 2 not ack'd Bit 4: 1 = Virtual channel 2 Alarm 1 active Bit 5: 1 = Virtual channel 2 Alarm 1 not ack'd Bit 6: 1 = Virtual channel 2 Alarm 2 active Bit 7: 1 = Virtual channel 2 Alarm 2 not ack'd Bit 8: 1 = Virtual channel 3 Alarm 1 active Bit 9: 1 = Virtual channel 3 Alarm 1 not ack'd Bit 10: 1 = Virtual channel 3 Alarm 2 active Bit 11: 1 = Virtual channel 3 Alarm 2 not ack'd Bit 12: 1 = Virtual channel 4 Alarm 1 active Bit 13: 1 = Virtual channel 4 Alarm 1 not ack'd Bit 14: 1 = Virtual channel 4 Alarm 2 active Bit 15: 1 = Virtual channel 4 Alarm 2 not ack'd	int16	01a5	421	Not applicable
AlarmSummary.StatusWord3	A summary of Virtual Channel 5 to 8 alarms As for Status Word 2 but for virtual channs 5 to 8	int16	01a6	422	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
AlarmSummary.StatusWord4	A summary of Virtual Channel 9 to 12 alarms As for Status Word 2 but for virtual channs 9 to 12	int16	01a7	423	Not applicable
AlarmSummary.StatusWord5	A summary of Virtual Channel 13 to 14 alarms As for Status Word 2 but for virtual channs 13 to 14	int16	01a8	424	Not applicable
AlarmSummary.System.Alarm1ID	Most recent active system alarm	uint8	1210	4624	Not applicable
AlarmSummary.System.Alarm2ID	2nd most recent active system alarm	uint8	1211	4625	Not applicable
AlarmSummary.System.Alarm3ID	3rd most recent active system alarm	uint8	1212	4626	Not applicable
AlarmSummary.System.Alarm4ID	4th most recent active system alarm	uint8	1213	4627	Not applicable
AlarmSummary.System.Alarm5ID	5th most recent active system alarm	uint8	1214	4628	Not applicable
AlarmSummary.System.Alarm6ID	6th most recent active system alarm	uint8	1215	4629	Not applicable
AlarmSummary.System.Alarm7ID	7th most recent active system alarm	uint8	1216	4630	Not applicable
AlarmSummary.System.Alarm8ID	8th most recent active system alarm	uint8	1217	4631	Not applicable
AlarmSummary.System.Alarm9ID	9th most recent active system alarm	uint8	1218	4632	Not applicable
AlarmSummary.System.Alarm10ID	10th most recent active system alarm	uint8	1219	4633	Not applicable
AlarmSummary.System.Alarm11ID	11th most recent active system alarm	uint8	121a	4634	Not applicable
AlarmSummary.System.Alarm12ID	12th most recent active system alarm	uint8	121b	4635	Not applicable
AlarmSummary.System.Alarm13ID	13th most recent active system alarm	uint8	121c	4636	Not applicable
AlarmSummary.System.Alarm14ID	14th most recent active system alarm	uint8	121d	4637	Not applicable
AlarmSummary.System.Alarm15ID	15th most recent active system alarm	uint8	121e	4638	Not applicable
AlarmSummary.System.Alarm16ID	16th most recent active system alarm	uint8	121f	4639	Not applicable
AlarmSummary.System.Alarm17ID	17th most recent active system alarm	uint8	1220	4640	Not applicable
AlarmSummary.System.Alarm18ID	18th most recent active system alarm	uint8	1221	4641	Not applicable
AlarmSummary.System.Alarm19ID	19th most recent active system alarm	uint8	1222	4642	Not applicable
AlarmSummary.System.Alarm20ID	20th most recent active system alarm	uint8	1223	4643	Not applicable
AlarmSummary.System.Alarm21ID	21st most recent active system alarm	uint8	1224	4644	Not applicable
AlarmSummary.System.Alarm22ID	22nd most recent active system alarm	uint8	1225	4645	Not applicable
AlarmSummary.System.Alarm23ID	23rd most recent active system alarm	uint8	1226	4646	Not applicable
AlarmSummary.System.Alarm24ID	24th most recent active system alarm	uint8	1227	4647	Not applicable
AlarmSummary.System.Alarm25ID	25th most recent active system alarm	uint8	1228	4648	Not applicable
AlarmSummary.System.Alarm26ID	26th most recent active system alarm	uint8	1229	4649	Not applicable
AlarmSummary.System.Alarm27ID	27th most recent active system alarm	uint8	122a	4650	Not applicable
AlarmSummary.System.Alarm28ID	28th most recent active system alarm	uint8	122b	4651	Not applicable
AlarmSummary.System.Alarm29ID	29th most recent active system alarm	uint8	122c	4652	Not applicable
AlarmSummary.System.Alarm30ID	30th most recent active system alarm	uint8	122d	4653	Not applicable
AlarmSummary.System.Alarm31ID	31st most recent active system alarm	uint8	122e	4654	Not applicable
AlarmSummary.System.Alarm32ID	32nd most recent active system alarm	uint8	122f	4655	Not applicable
Channel.1.Alarm1.Acknowledge	1 = Acknowledge alarm	bool	01b0	432	Not applicable
Channel.1.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1850	6224	Not applicable
Channel.1.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	184b	6219	Not applicable
Channel.1.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1848	6216	Same as Channel.1.Main.PV
Channel.1.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	184a	6218	Set by Network.Modbus.TimeFormat
Channel.1.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1842	6210	Not applicable
Channel.1.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1849	6217	Not applicable
Channel.1.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1847	6215	Same as Channel.1.Main.PV
Channel.1.Alarm1.Dwell	Alarm dwell time	time_t	1845	6213	Set by Network.Modbus.TimeFormat
Channel.1.Alarm1.Hysteresis	Alarm hysteresis value	float32	1844	6212	Same as Channel.1.Main.PV
Channel.1.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	184e	6222	Not applicable
Channel.1.Alarm1.Latch	Alarm latch type 0 = None 1 = Auto 2 = Manual 3 = Trigger	uint8	1841	6209	Not applicable
Channel.1.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	184f	6223	Not applicable
Channel.1.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1846	6214	Same as Channel.1.Main.PV
Channel.1.Alarm1.Status	Alarm status 0 = Unacknowledged 1 = None 2 = Active 3 = Inactive 4 = Acknowledged	uint8	0102	258	Not applicable
Channel.1.Alarm1.Threshold	Alarm trigger threshold	float32	1843	6211	Same as Channel.1.Main.PV
Channel.1.Alarm1.Type	Alarn type 0 = None 1 = Abs High 2 = Abs Low 3 = Dev high 4 = Dev Low 5 = Dev band 6 = ROC rising 7 = ROC falling 10 = Dig Off 11 = Dig high 12 = Dig Low	uint8	1840	6208	Not applicable
Channel.1.Alarm2.Acknowledge	1 = Acknowledge alarm	bool	01b1	433	Not applicable
Channel.1.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1870	6256	Not applicable
Channel.1.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	186b	6251	Not applicable
Channel.1.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1868	6248	Same as Channel.1.Main.PV
Channel.1.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	186a	6250	Set by Network.Modbus.TimeFormat
Channel.1.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1862	6242	Not applicable
Channel.1.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1869	6249	Not applicable
Channel.1.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1867	6247	Same as Channel.1.Main.PV
Channel.1.Alarm2.Dwell	Alarm dwell time	time_t	1865	6245	Set by Network.Modbus.TimeFormat
Channel.1.Alarm2.Hysteresis	Alarm hysteresis value	float32	1864	6244	Same as Channel.1.Main.PV
Channel.1.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	186e	6254	Not applicable
Channel.1.Alarm2.Latch	As channel.1.Alarm.1.Latch	uint8	1861	6241	Not applicable
Channel.1.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	186f	6255	Not applicable
Channel.1.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1866	6246	Same as Channel.1.Main.PV
Channel.1.Alarm2.Status	As channel.1.Alarm.1.Status	uint8	0103	259	Not applicable
Channel.1.Alarm2.Threshold	Alarm trigger threshold	float32	1863	6243	Same as Channel.1.Main.PV
Channel.1.Alarm2.Type	As channel.1.Alarm.1.Status	uint8	1860	6240	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.1.Main.CJType	Cold junction compensation type 0 = Internal 1 = External 2 = Remote (Ch1) 3 =Remote (Ch2) 4 = Remote (Ch3) 5 = Remote (Ch4)	uint8	180c	6156	Not applicable
Channel.1.Main.Descriptor	Text string to describe the channel	string_t	4900	18688	Not applicable
Channel.1.Main.ExtCJTemp	External CJ temperature	float32	180d	6157	1dp
Channel.1.Main.FaultResponse	Fault response. 0 = none; 1 = Drive high; 2 = Drive low	uint8	1810	6160	Not applicable
Channel.1.Main.Filter	Filter time constant	float32	180e	6158	1dp
Channel.1.Main.InputHigh	Input range maximum value	float32	1804	6148	1dp
Channel.1.Main.InputLow	Input range minimum value	float32	1803	6147	1dp
Channel.1.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1815	6165	1dp
Channel.1.Main.IPAdjustState	0 = Unadjusted; 1 = Adjusted	bool	1816	6166	Not applicable
Channel.1.Main.LinType	Linearisation type 0 =Type B 1 = Type C 2 = Type D 3 = Type E 4 = Type G2 5 = Type J 6 =Type K 7 = Type L 8 = Type N 9 = Type R 10 = Type S 11 = Type T 12 = Type U 13 = NoMoNiCo 14 = Platinel 15 = NiNiMo 16 = Pt20RhPt40Rh 17 = Cu10 18 = Pt100 19 = Pt100A 20 = JPT100 21 = Ni100 22 = Ni120 23 = Cu53 24 = Linear 25 = Sqrt 26 = $x^{3/2}$ 27 = $x^{5/2}$	uint8	1806	6150	Not applicable
Channel.1.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1814	6164	Set by Channel.1.Main.Resolution
Channel.1.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1817	6167	3dp
Channel.1.Main.PV	The output (displayed) value of the channel.	float32	0100	256	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeHigh	Range high value	float32	1808	6152	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeLow	Range low value	float32	1807	6151	Set by Channel.1.Main.Resolution
Channel.1.Main.RangeUnits	Range units: 0 = °C; 1 = °F; 2 = Kelvins	uint8	1809	6153	Not applicable
Channel.1.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1801	6145	Not applicable
Channel.1.Main.ScaleHigh	Scale high value	float32	180b	6155	Set by Channel.1.Main.Resolution
Channel.1.Main.ScaleLow	Scale low value	float32	180a	6154	Set by Channel.1.Main.Resolution
Channel.1.Main.SensorBreakType	Sensor break type: 0 =Off; 1 = Low; 2 = High	uint8	180f	6159	Not applicable
Channel.1.Main.SensorBreakVal	A diagnostive indication of the input impedance	uint8	1811	6161	Not applicable
Channel.1.Main.Shunt	Shunt value (Ohms)	float32	1805	6149	1dp
Channel.1.Main.Status	The PV (output) status 0 =Good 1 = Off 2 = Over range 3 = Under range 4 = HW error 5 = Ranging 6 = Overflow 7 = bad 8 = HW exceeded 9 = No data 12 = Comm channel error	uint8	0101	257	Not applicable
Channel.1.Main.TestSignal	Channel test waveform 0 = Triangle 5hr 1 = Triangle 40 min 2 = Triangle 4 min 3 = triangle 40 sec 4 = Sine 5 hr 5 = Sine 40 min 6 = Sine 4 min 7 = Sine 40 sec	uint8	1802	6146	Not applicable
Channel.1.Main.Type	Specifies the type of channel 0 = Off 1 = TC 2 = mV 3 = V 4 = mA 5 = RTD 6 = Digital 7 = Test	uint8	1800	6144	Not applicable
Channel.1.Main.Units	Units descriptor	string_t	4915	18709	Not applicable
Channel.1.Trend.Colour	Configures the trend colour for this channel 0 = Red 1 = Blue 2 = Green 3 = Honey 4 = Violet 5 = Russet 6 = Dark blue 7 = Jade 8 = Magenta 9 = Dusky rose 10 = Yellow 11 = Powder blue 12 = Dark red 13 = Avocado 14 = Indigo 15 = Dark brown 16 = Aegean 17 = Cyan 18 = Aubergine 19 = Dark orange 20 = Pale yellow 21 = Hyacinth 22 = Dark green 23 = Sugar pink 24 = Bluebell 25 = Orange 26 = Pink 27 = Buttersilk 28 = Terracotta 29 = Blue babe 30 = Lime 31 = Blue jive 32 = Cucumber 33 = Eurogreen 34 = Wheatgerm 35 = Sea Blue 36 = Ginger 37 = Aqua pool 38 = Pale red 39 = Pale blue 40 = Lilac 41 = Sky blue 42 = Wild moss 43 = Turquoise 44 = Pale green 45 = Coffee 49 = Dark Grey 53 = Light grey	uint8	1820	6176	Not applicable
Channel.1.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1822	6178	Same as Channel.1.Main.PV
Channel.1.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1821	6177	Same as Channel.1.Main.PV
Channel.2.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01b2	434	Not applicable
Channel.2.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	18d0	6352	Not applicable
Channel.2.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	18cb	6347	Not applicable
Channel.2.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	18c8	6344	Same as Channel.2.Main.PV
Channel.2.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	18ca	6346	Set by Network.Modbus.TimeFormat
Channel.2.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	18c2	6338	Not applicable
Channel.2.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	18c9	6345	Not applicable
Channel.2.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	18c7	6343	Same as Channel.2.Main.PV
Channel.2.Alarm1.Dwell	Alarm dwell time	time_t	18c5	6341	Set by Network.Modbus.TimeFormat
Channel.2.Alarm1.Hysteresis	Alarm hysteresis value	float32	18c4	6340	Same as Channel.2.Main.PV
Channel.2.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	18ce	6350	Not applicable
Channel.2.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	18c1	6337	Not applicable
Channel.2.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	18cf	6351	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.2.Alarm1.Reference	Deviation alarm 'Reference' value	float32	18c6	6342	Same as Channel.2.Main.PV
Channel.2.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	0106	262	Not applicable
Channel.2.Alarm1.Threshold	Alarm trigger threshold	float32	18c3	6339	Same as Channel.2.Main.PV
Channel.2.Alarm1.Type	Alarn type (as for Channel.1.Alarm1)	uint8	18c0	6336	Not applicable
Channel.2.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b3	435	Not applicable
Channel.2.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	18f0	6384	Not applicable
Channel.2.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	18eb	6379	Not applicable
Channel.2.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	18e8	6376	Same as Channel.2.Main.PV
Channel.2.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	18ea	6378	Set by Network.Modbus.TimeFormat
Channel.2.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	18e2	6370	Not applicable
Channel.2.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	18e9	6377	Not applicable
Channel.2.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	18e7	6375	Same as Channel.2.Main.PV
Channel.2.Alarm2.Dwell	Alarm dwell time	time_t	18e5	6373	Set by Network.Modbus.TimeFormat
Channel.2.Alarm2.Hysteresis	Alarm hysteresis value	float32	18e4	6372	Same as Channel.2.Main.PV
Channel.2.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	18ee	6382	Not applicable
Channel.2.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	18e1	6369	Not applicable
Channel.2.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	18ef	6383	Not applicable
Channel.2.Alarm2.Reference	Deviation alarm 'Reference' value	float32	18e6	6374	Same as Channel.2.Main.PV
Channel.2.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	0107	263	Not applicable
Channel.2.Alarm2.Threshold	Alarm trigger threshold	float32	18e3	6371	Same as Channel.2.Main.PV
Channel.2.Alarm2.Type	Alarn type (as for Channel.1.Alarm1)	uint8	18e0	6368	Not applicable
Channel.2.Main.CJType	Cold junction compensation type (as for Channel.1.Main)	uint8	188c	6284	Not applicable
Channel.2.Main.Descriptor	Channel descriptor	string_t	491b	18715	Not applicable
Channel.2.Main.ExtCJTemp	External CJ temperature	float32	188d	6285	1dp
Channel.2.Main.FaultResponse	Fault response (as for Channel.1.Main)	uint8	1890	6288	Not applicable
Channel.2.Main.Filter	Filter time constant	float32	188e	6286	1dp
Channel.2.Main.InputHigh	Input range maximum value	float32	1884	6276	1dp
Channel.2.Main.InputLow	Input range minimum value	float32	1883	6275	1dp
Channel.2.Main.InternalCJTemp	Channel 2 internal cold junction temperature	float32	1895	6293	1dp
Channel.2.Main.IPAdjustState	0 = Channel unadjusted; 1 = Channel adjusted	bool	1896	6294	Not applicable
Channel.2.Main.LinType	Linearisation type (as for Channel.1.Main)	uint8	1886	6278	Not applicable
Channel.2.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1894	6292	Set by Channel.2.Main.Resolution
Channel.2.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1897	6295	3dp
Channel.2.Main.PV	The output (displayed) value of the channel.	float32	0104	260	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeHigh	Range high value	float32	1888	6280	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeLow	Range low value	float32	1887	6279	Set by Channel.2.Main.Resolution
Channel.2.Main.RangeUnits	Range units (as channel.1.Main)	uint8	1889	6281	Not applicable
Channel.2.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1881	6273	Not applicable
Channel.2.Main.ScaleHigh	Scale high value	float32	188b	6283	Set by Channel.2.Main.Resolution
Channel.2.Main.ScaleLow	Scale low value	float32	188a	6282	Set by Channel.2.Main.Resolution
Channel.2.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	188f	6287	Not applicable
Channel.2.Main.SensorBreakVal	A diagnostive indication of the input impedance	uint8	1891	6289	Not applicable
Channel.2.Main.Shunt	Shunt value in Ohms	float32	1885	6277	1dp
Channel.2.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	0105	261	Not applicable
Channel.2.Main.TestSignal	Channel test waveform (as for Channel.1.Main)	uint8	1882	6274	Not applicable
Channel.2.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1880	6272	Not applicable
Channel.2.Main.Units	Channel units string	string_t	4930	18736	Not applicable
Channel.2.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	18a0	6304	Not applicable
Channel.2.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	18a2	6306	Same as Channel.2.Main.PV
Channel.2.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	18a1	6305	Same as Channel.2.Main.PV
Channel.3.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01b4	436	Not applicable
Channel.3.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1950	6480	Not applicable
Channel.3.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	194b	6475	Not applicable
Channel.3.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1948	6472	Same as Channel.3.Main.PV
Channel.3.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	194a	6474	Set by Network.Modbus.TimeFormat
Channel.3.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1942	6466	Not applicable
Channel.3.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1949	6473	Not applicable
Channel.3.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1947	6471	Same as Channel.3.Main.PV
Channel.3.Alarm1.Dwell	Alarm dwell time	time_t	1945	6469	Set by Network.Modbus.TimeFormat
Channel.3.Alarm1.Hysteresis	Alarm hysteresis value	float32	1944	6468	Same as Channel.3.Main.PV
Channel.3.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	194e	6478	Not applicable
Channel.3.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	1941	6465	Not applicable
Channel.3.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	194f	6479	Not applicable
Channel.3.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1946	6470	Same as Channel.3.Main.PV
Channel.3.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010a	266	Not applicable
Channel.3.Alarm1.Threshold	Alarm trigger threshold	float32	1943	6467	Same as Channel.3.Main.PV
Channel.3.Alarm1.Type	Alarn type (as for Channel.1.Alarm1)	uint8	1940	6464	Not applicable
Channel.3.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b5	437	Not applicable
Channel.3.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1970	6512	Not applicable
Channel.3.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	196b	6507	Not applicable
Channel.3.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1968	6504	Same as Channel.3.Main.PV
Channel.3.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	196a	6506	Set by Network.Modbus.TimeFormat
Channel.3.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	1962	6498	Not applicable
Channel.3.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1969	6505	Not applicable
Channel.3.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1967	6503	Same as Channel.3.Main.PV
Channel.3.Alarm2.Dwell	Alarm dwell time	time_t	1965	6501	Set by Network.Modbus.TimeFormat
Channel.3.Alarm2.Hysteresis	Alarm hysteresis value	float32	1964	6500	Same as Channel.3.Main.PV
Channel.3.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	196e	6510	Not applicable
Channel.3.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	1961	6497	Not applicable
Channel.3.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	196f	6511	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.3.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1966	6502	Same as Channel.3.Main.PV
Channel.3.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010b	267	Not applicable
Channel.3.Alarm2.Threshold	Alarm trigger threshold	float32	1963	6499	Same as Channel.3.Main.PV
Channel.3.Alarm2.Type	Alarn type (as for Channel.1.Alarm1)	uint8	1960	6496	Not applicable
Channel.3.Main.CJType	Cold junction compensation type (as for Channel.1.Main)	uint8	190c	6412	Not applicable
Channel.3.Main.Descriptor	Text string to describe the channel	string_t	4936	18742	Not applicable
Channel.3.Main.ExtCJTemp	External CJ temperature	float32	190d	6413	1dp
Channel.3.Main.FaultResponse	Fault response (as for Channel.1.Main)	uint8	1910	6416	Not applicable
Channel.3.Main.Filter	Filter time constant	float32	190e	6414	1dp
Channel.3.Main.InputHigh	Input range maximum value	float32	1904	6404	1dp
Channel.3.Main.InputLow	Input range minimum value	float32	1903	6403	1dp
Channel.3.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1915	6421	1dp
Channel.3.Main.IPAdjustState	0 = Channel unadjusted; 1 = Channel adjusted	bool	1916	6422	Not applicable
Channel.3.Main.LinType	Linearisation type (as for Channel.1.Main.LinType)	uint8	1906	6406	Not applicable
Channel.3.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1914	6420	Set by Channel.3.Main.Resolution
Channel.3.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1917	6423	3dp
Channel.3.Main.PV	The output (displayed) value of the channel.	float32	0108	264	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeHigh	Range high value	float32	1908	6408	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeLow	Range low value	float32	1907	6407	Set by Channel.3.Main.Resolution
Channel.3.Main.RangeUnits	Range units (as channel.1.Main.Units)	uint8	1909	6409	Not applicable
Channel.3.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1901	6401	Not applicable
Channel.3.Main.ScaleHigh	Scale high value	float32	190b	6411	Set by Channel.3.Main.Resolution
Channel.3.Main.ScaleLow	Scale low value	float32	190a	6410	Set by Channel.3.Main.Resolution
Channel.3.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	190f	6415	Not applicable
Channel.3.Main.SensorBreakVal	A diagnostive indication of the input impedance	uint8	1911	6417	Not applicable
Channel.3.Main.Shunt	Shunt value in Ohms	float32	1905	6405	1dp
Channel.3.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	0109	265	Not applicable
Channel.3.Main.TestSignal	Channel test waveform (as for Channel.1.Main)	uint8	1902	6402	Not applicable
Channel.3.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1900	6400	Not applicable
Channel.3.Main.Units	Channel units string	string_t	494b	18763	Not applicable
Channel.3.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	1920	6432	Not applicable
Channel.3.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1922	6434	Same as Channel.3.Main.PV
Channel.3.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1921	6433	Same as Channel.3.Main.PV
Channel.4.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01b6	438	Not applicable
Channel.4.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	19d0	6608	Not applicable
Channel.4.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	19cb	6603	Not applicable
Channel.4.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	19c8	6600	Same as Channel.4.Main.PV
Channel.4.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	19ca	6602	Set by Network.Modbus.TimeFormat
Channel.4.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on.	uint8	19c2	6594	Not applicable
Channel.4.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	19c9	6601	Not applicable
Channel.4.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	19c7	6599	Same as Channel.4.Main.PV
Channel.4.Alarm1.Dwell	Alarm dwell time	time_t	19c5	6597	Set by Network.Modbus.TimeFormat
Channel.4.Alarm1.Hysteresis	Alarm hysteresis value	float32	19c4	6596	Same as Channel.4.Main.PV
Channel.4.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	19ce	6606	Not applicable
Channel.4.Alarm1.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	19c1	6593	Not applicable
Channel.4.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	19cf	6607	Not applicable
Channel.4.Alarm1.Reference	Deviation alarm 'Reference' value	float32	19c6	6598	Same as Channel.4.Main.PV
Channel.4.Alarm1.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010e	270	Not applicable
Channel.4.Alarm1.Threshold	Alarm trigger threshold	float32	19c3	6595	Same as Channel.4.Main.PV
Channel.4.Alarm1.Type	Alarn type (as for Channel.1.Alarm1)	uint8	19c0	6592	Not applicable
Channel.4.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01b7	439	Not applicable
Channel.4.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	19f0	6640	Not applicable
Channel.4.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	19eb	6635	Not applicable
Channel.4.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	19e8	6632	Same as Channel.4.Main.PV
Channel.4.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	19ea	6634	Set by Network.Modbus.TimeFormat
Channel.4.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	19e2	6626	Not applicable
Channel.4.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	19e9	6633	Not applicable
Channel.4.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	19e7	6631	Same as Channel.4.Main.PV
Channel.4.Alarm2.Dwell	Alarm dwell time	time_t	19e5	6629	Set by Network.Modbus.TimeFormat
Channel.4.Alarm2.Hysteresis	Alarm hysteresis value	float32	19e4	6628	Same as Channel.4.Main.PV
Channel.4.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	19ee	6638	Not applicable
Channel.4.Alarm2.Latch	Alarm latch type (as for Channel.1.Alarm1)	uint8	19e1	6625	Not applicable
Channel.4.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	19ef	6639	Not applicable
Channel.4.Alarm2.Reference	Deviation alarm 'Reference' value	float32	19e6	6630	Same as Channel.4.Main.PV
Channel.4.Alarm2.Status	Alarm status (as for Channel.1.Alarm1)	uint8	010f	271	Not applicable
Channel.4.Alarm2.Threshold	Alarm trigger threshold	float32	19e3	6627	Same as Channel.4.Main.PV
Channel.4.Alarm2.Type	Alarn type (as for Channel.1.Alarm1)	uint8	19e0	6624	Not applicable
Channel.4.Main.CJType	Cold junction compensation type(as for Channel.1.Main)	uint8	198c	6540	Not applicable
Channel.4.Main.Descriptor	Text string to describe the channel	string_t	4951	18769	Not applicable
Channel.4.Main.ExtCJTemp	External CJ temperature	float32	198d	6541	1dp
Channel.4.Main.FaultResponse	Fault response (as for Channel.1.Main)	uint8	1990	6544	Not applicable
Channel.4.Main.Filter	Filter time constant	float32	198e	6542	1dp
Channel.4.Main.InputHigh	Input range maximum value	float32	1984	6532	1dp
Channel.4.Main.InputLow	Input range minimum value	float32	1983	6531	1dp
Channel.4.Main.InternalCJTemp	Channel internal cold junction temperature	float32	1995	6549	1dp
Channel.4.Main.IPAdjustState	0 = Channel unadjusted; 1 = Channel adjusted	bool	1996	6550	Not applicable
Channel.4.Main.LinType	Linearisation type (as for Channel.1.Main.LinType)	uint8	1986	6534	Not applicable
Channel.4.Main.MeasuredValue	Input value before linearisation, scaling, adjust etc.	float32	1994	6548	Set by Channel.4.Main.Resolution
Channel.4.Main.Offset	Fixed value to be added to/subtracted from PV	float32	1997	6551	3dp
Channel.4.Main.PV	The output (displayed) value of the channel.	float32	010c	268	Set by Channel.4.Main.Resolution

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Channel.4.Main.RangeHigh	Range high value	float32	1988	6536	Set by Channel.4.Main.Resolution
Channel.4.Main.RangeLow	Range low value	float32	1987	6535	Set by Channel.4.Main.Resolution
Channel.4.Main.RangeUnits	Range units (as channel.1.Main.RangeUnits)	uint8	1989	6537	Not applicable
Channel.4.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1981	6529	Not applicable
Channel.4.Main.ScaleHigh	Scale high value	float32	198b	6539	Set by Channel.4.Main.Resolution
Channel.4.Main.ScaleLow	Scale low value	float32	198a	6538	Set by Channel.4.Main.Resolution
Channel.4.Main.SensorBreakType	Sensor break type (as for Channel.1.Main)	uint8	198f	6543	Not applicable
Channel.4.Main.SensorBreakVal	A diagnostive indication of the input impedance	uint8	1991	6545	Not applicable
Channel.4.Main.Shunt	Shunt value in Ohms	float32	1985	6533	1dp
Channel.4.Main.Status	Channel status (as for Channel.1.Main.Status)	uint8	010d	269	Not applicable
Channel.4.Main.TestSignal	Channel test waveform (as for Channel.1.Main.TestSignal)	uint8	1982	6530	Not applicable
Channel.4.Main.Type	Channel function (as for Channel.1.Main.Type)	uint8	1980	6528	Not applicable
Channel.4.Main.Units	Units descriptor	string_t	4966	18790	Not applicable
Channel.4.Trend.Colour	Trend colour (as for Channel.1.Trend.Colour)	uint8	19a0	6560	Not applicable
Channel.4.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	19a2	6562	Same as Channel.4.Main.PV
Channel.4.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	19a1	6561	Same as Channel.4.Main.PV
CustomMessage.Message1	Custom Message No. 1	string_t	5e00	24064	Not applicable
CustomMessage.Message2	Custom Message No. 2	string_t	5e65	24165	Not applicable
CustomMessage.Message3	Custom Message No. 3	string_t	5eca	24266	Not applicable
CustomMessage.Message4	Custom Message No. 4	string_t	5f2f	24367	Not applicable
CustomMessage.Message5	Custom Message No. 5	string_t	5f94	24468	Not applicable
CustomMessage.Message6	Custom Message No. 6	string_t	5ff9	24569	Not applicable
CustomMessage.Message7	Custom Message No. 7	string_t	605e	24670	Not applicable
CustomMessage.Message8	Custom Message No. 8	string_t	60c3	24771	Not applicable
CustomMessage.Message9	Custom Message No. 9	string_t	6128	24872	Not applicable
CustomMessage.Message10	Custom Message No. 10	string_t	618d	24973	Not applicable
CustomMessage.Trigger1	Custom message No. 1 trigger	bool	28f0	10480	Not applicable
CustomMessage.Trigger2	Custom message No. 2 trigger	bool	28f1	10481	Not applicable
CustomMessage.Trigger3	Custom message No. 3 trigger	bool	28f2	10482	Not applicable
CustomMessage.Trigger4	Custom message No. 4 trigger	bool	28f3	10483	Not applicable
CustomMessage.Trigger5	Custom message No. 5 trigger	bool	28f4	10484	Not applicable
CustomMessage.Trigger6	Custom message No. 6 trigger	bool	28f5	10485	Not applicable
CustomMessage.Trigger7	Custom message No. 7 trigger	bool	28f6	10486	Not applicable
CustomMessage.Trigger8	Custom message No. 8 trigger	bool	28f7	10487	Not applicable
CustomMessage.Trigger9	Custom message No. 9 trigger	bool	28f8	10488	Not applicable
CustomMessage.Trigger10	Custom message No. 10 trigger	bool	28f9	10489	Not applicable
DigitalIO.1.Invert	Invert signal. 0 = Do not invert; 1 = Invert	bool	1503	5379	Not applicable
DigitalIO.1.MinOnTime	Minimum on time for time proportioned outputs	float32	1502	5378	2dp
DigitalIO.1.Output	0 = output off; 1 = output on.	bool	1504	5380	Not applicable
DigitalIO.1.PV	For contact inputs, 0 = open; 1 = closed For On Off outouts, <0.5 = drive low, else drive high For Time proportional outputs, PV = demanded output %	float32	1501	5377	0dp
DigitalIO.1.Type	Digital I/O type 0 = Contact input 1 = On Off output 2 = Time proprtioning output 3 = Valve raise 4 = Valve lower	uint8	1500	5376	Not applicable
DigitalIO.2.Backlash	Valve positioning linkage backlash compensation (seconds)	float32	1518	5400	1dp
DigitalIO.2.Inertia	Inertia value for the valve	float32	1517	5399	1dp
DigitalIO.2.Invert	0 = Do not invert; 1 = Invert	bool	1513	5395	Not applicable
DigitalIO.2.MinOnTime	Minimum on time for time proportioned outputs	float32	1512	5394	2dp
DigitalIO.2.Output	0 = output off; 1 = output on	bool	1514	5396	Not applicable
DigitalIO.2.PV	As DigitalIO.1.PV	float32	1511	5393	0dp
DigitalIO.2.Standby action	For valve positioning: 0 = Continue; 1 = Freeze	uint8	1519	5401	Not applicable
DigitalIO.2.Type	As DigitalIO.1.Type	uint8	1510	5392	Not applicable
DigitalIO.3.Invert	0 = Do not invert; 1 = Invert	bool	1523	5411	Not applicable
DigitalIO.3.MinOnTime	Minimum on time for time proportioned outputs	float32	1522	5410	2dp
DigitalIO.3.Output	0 = output off; 1 = output on	bool	1524	5412	Not applicable
DigitalIO.3.PV	As DigitalIO.1.PV	float32	1521	5409	0dp
DigitalIO.3.Type	As DigitalIO.1.Type	uint8	1520	5408	Not applicable
DigitalIO.4.Invert	0 = Do not invert; 1 = Invert	bool	1533	5427	Not applicable
DigitalIO.4.MinOnTime	Minimum on time for time proportioned outputs	float32	1532	5426	2dp
DigitalIO.4.Output	0 = output off; 1 = output on	bool	1534	5428	Not applicable
DigitalIO.4.PV	As DigitalIO.1.PV	float32	1531	5425	0dp
DigitalIO.4.Type	As DigitalIO.1.Type	uint8	1530	5424	Not applicable
DigitalIO.5.Invert	0 = Do not invert; 1 = Invert	bool	1543	5443	Not applicable
DigitalIO.5.MinOnTime	Minimum on time for time proportioned outputs	float32	1542	5442	2dp
DigitalIO.5.Output	0 = output off; 1 = output on	bool	1544	5444	Not applicable
DigitalIO.5.PV	As DigitalIO.1.PV	float32	1541	5441	0dp
DigitalIO.5.Type	As DigitalIO.1.Type	uint8	1540	5440	Not applicable
DigitalIO.6.Backlash	Valve positioning linkage backlash compensation (seconds)	float32	1558	5464	1dp
DigitalIO.6.Inertia	Inertia value for the valve	float32	1557	5463	1dp
DigitalIO.6.Invert	0 = Do not invert; 1 = Invert	bool	1553	5459	Not applicable
DigitalIO.6.MinOnTime	Minimum on time for time proportioned outputs	float32	1552	5458	2dp
DigitalIO.6.Output	0 = output off; 1 = output on	bool	1554	5460	Not applicable
DigitalIO.6.PV	As DigitalIO.1.PV	float32	1551	5457	0dp
DigitalIO.6.StandbyAction	For valve positioning: 0 = Continue; 1 = Freeze	uint8	1559	5465	Not applicable
DigitalIO.6.Type	As DigitalIO.1.Type	uint8	1550	5456	Not applicable
DigitalIO.7.Invert	0 = Do not invert; 1 = Invert	bool	1563	5475	Not applicable
DigitalIO.7.MinOnTime	0 = Do not invert; 1 = Invert	float32	1562	5474	2dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
DigitalIO.7.Output	0 = output off; 1 = output on	bool	1564	5476	Not applicable
DigitalIO.7.PV	As DigitalIO.1.PV	float32	1561	5473	0dp
DigitalIO.7.Type	As DigitalIO.1.Type	uint8	1560	5472	Not applicable
Group.Recording.Channel1En	Channel 1 enable (0 = Disabled; 1 = Enabled)	bool	1023	4131	Not applicable
Group.Recording.Channel2En	Channel 2 enable (0 = Disabled; 1 = Enabled)	bool	1024	4132	Not applicable
Group.Recording.Channel3En	Channel 3 enable (0 = Disabled; 1 = Enabled)	bool	1025	4133	Not applicable
Group.Recording.Channel4En	Channel 4 enable (0 = Disabled; 1 = Enabled)	bool	1026	4134	Not applicable
Group.Recording.Compression	The UHH file compression rate (0 = Normal; 1 = High)	uint8	1040	4160	Not applicable
Group.Recording.Enable	0 = Recording disabled; 1 = Recording enabled	uint8	1020	4128	Not applicable
Group.Recording.FlashDuration	Time in days until flash history files begin to be overwitten	float32	1039	4153	2dp
Group.Recording.FlashFree	Unused space in the internal flash in MBytes	float32	1038	4152	2dp
Group.Recording.FlashSize	Size of the internal flash in MBytes	float32	1037	4151	2dp
Group.Recording.Interval	Recording interval 0 =8Hz 1 = 4 Hz 2 = 2Hz 3 = 1Hz 4 = 2 sec 5 = 5 sec 6 = 10 sec 7 = 20 sec 8 = 30 sec 9 = 1 min 10 = 2 min 11 = 5 min 12 = 10 min 13 = 20 min 14 = 30 min 15 = 1 hr	int32	1022	4130	Not applicable
Group.Recording.Status	Recording status 0 = Not recording 1 = Disabled 2 = Messages only 3 = Recording enabled 4 = Recording paused	int16	1036	4150	Not applicable
Group.Recording.Suspend	1 = Suspend recording	bool	1035	4149	Not applicable
Group.Recording.VirtualChan1En	Virtual Channel 1 enable (0 = Disabled; 1 = Enabled)	bool	1027	4135	Not applicable
Group.Recording.VirtualChan2En	Virtual Channel 2 enable (0 = Disabled; 1 = Enabled)	bool	1028	4136	Not applicable
Group.Recording.VirtualChan3En	Virtual Channel 3 enable (0 = Disabled; 1 = Enabled)	bool	1029	4137	Not applicable
Group.Recording.VirtualChan4En	Virtual Channel 4 enable (0 = Disabled; 1 = Enabled)	bool	102a	4138	Not applicable
Group.Recording.VirtualChan5En	Virtual Channel 5 enable (0 = Disabled; 1 = Enabled)	bool	102b	4139	Not applicable
Group.Recording.VirtualChan6En	Virtual Channel 6 enable (0 = Disabled; 1 = Enabled)	bool	102c	4140	Not applicable
Group.Recording.VirtualChan7En	Virtual Channel 7 enable (0 = Disabled; 1 = Enabled)	bool	102d	4141	Not applicable
Group.Recording.VirtualChan8En	Virtual Channel 8 enable (0 = Disabled; 1 = Enabled)	bool	102e	4142	Not applicable
Group.Recording.VirtualChan9En	Virtual Channel 9 enable (0 = Disabled; 1 = Enabled)	bool	102f	4143	Not applicable
Group.Recording.VirtualChan10En	Virtual Channel 10 enable (0 = Disabled; 1 = Enabled)	bool	1030	4144	Not applicable
Group.Recording.VirtualChan11En	Virtual Channel 11 enable (0 = Disabled; 1 = Enabled)	bool	1031	4145	Not applicable
Group.Recording.VirtualChan12En	Virtual Channel 12 enable (0 = Disabled; 1 = Enabled)	bool	1032	4146	Not applicable
Group.Recording.VirtualChan13En	Virtual Channel 13 enable (0 = Disabled; 1 = Enabled)	bool	1033	4147	Not applicable
Group.Recording.VirtualChan14En	Virtual Channel 14 enable (0 = Disabled; 1 = Enabled)	bool	1034	4148	Not applicable
Group.Trend.Descriptor	Group descriptor	string_t	5b00	23296	Not applicable
Group.Trend.Interval	Trend interval. As Group.Recording.Interval, above	int32	1002	4098	Not applicable
Group.Trend.MajorDivisions	Number of major divisions	uint8	1004	4100	Not applicable
Group.Trend.Point1	1st point in the group (VCh = Virtual channel) 0 =No trend 1 = Channel 1 2 = Channel 2 3 = Channel 3 4 = Channel 4 5 = VCh1 6 = VCh2 7 = VCh3 8 = VCh4 9 = VCh5 10 = VCh6 11 = VCh7 12 = VCh8 13 = VCh9 14 = VCh10 15 = VCh11 16 = VCh12 17 = VCH13 18 = VCh14	uint8	1006	4102	Not applicable
Group.Trend.Point2	As Group.Trend.Point1 but for 2nd point in group	uint8	1007	4103	Not applicable
Group.Trend.Point3	As Group.Trend.Point1 but for 3rd point in group	uint8	1008	4104	Not applicable
Group.Trend.Point4	As Group.Trend.Point1 but for 4th point in group	uint8	1009	4105	Not applicable
Group.Trend.Point5	As Group.Trend.Point1 but for 5th point in group	uint8	100a	4106	Not applicable
Group.Trend.Point6	As Group.Trend.Point1 but for 6th point in group	uint8	100b	4107	Not applicable
Instrument.Clock.Date	Local date	string_t	4400	17408	Not applicable
Instrument.Clock.DST	1= DST active; 0 = DST inactive	bool	1082	4226	Not applicable
Instrument.Clock.Time	Local time (including Zone and DST effects)	time_t	1081	4225	Set by Network.Modbus.TimeFormat
Instrument.Display.Brightness	Display brightness 10 = 10%; 20 = 20% etc. (whole decades)	uint8	1090	4240	Not applicable
Instrument.Display.DualLoopControl	1 = Dual loop control page available for use	bool	109b	4251	Not applicable
Instrument.Display.FaceplateCycling	1 = Faceplate cycling On	bool	109e	4254	Not applicable
Instrument.Display.HistoryBackground	History display background colour 0 = Black; 1 = Dark Grey; 2 = Light grey; 3 = White.	uint8	10A8	4264	Not applicable
Instrument.Display.HomePage	Home display page	uint8	1093	4243	Not applicable
Instrument.Display.HorizontalBar	1 = Horizontal bar mode enabled	bool	1098	4248	Not applicable
Instrument.Display.HorizontalTrend	1 = Horizontal trend mode enabled	bool	1096	4246	Not applicable
Instrument.Display.HPageTimeout	Home time out value in minutes (0 = no timeout)	int16	1094	4244	Not applicable
Instrument.Display.HTrendScaling	0 = hide horizontal trend scale; 1 = scale permanent	uint8	109d	4253	Not applicable
Instrument.Display.LoopControl	1 = Single loop control pages available for use	bool	109a	4250	Not applicable
Instrument.Display.LoopSetpointColour	Loop setpoint colour (As Channel.1.Trend.Colour)	uint8	109f	4255	Not applicable
Instrument.Display.Numeric	1 = Numeric mode enabled	bool	1099	4249	Not applicable
Instrument.Display.PromoteListView	1 = promote list display enabled	bool	10ea	4330	Not applicable
Instrument.Display.ScreenSaverAfter	Screen saver time in minures. 0 = off	int16	1091	4241	Not applicable
Instrument.Display.ScreenSaverBrightness	Screen saver brightness 10 = 10%; 20 = 20% etc. (whole decades only)	uint8	1092	4242	Not applicable
Instrument.Display.TrendBackground	Trend chart colour: 0 = Black; 1 = Dark Grey; 2 = Light grey; 3 = White.	uint8	109c	4252	Not applicable
Instrument.Display.VerticalBar	1 = vertical bar mode enabled	bool	1097	4247	Not applicable
Instrument.Display.VerticalTrend	1 = Vertical trend mode enabled	bool	1095	4245	Not applicable
Instrument.Info.Bootrom	BootROM version	string_t	447a	17530	Not applicable
Instrument.Info.CompanyID	Always returns 1280	int16	0079	121	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Instrument.Info.ConfigRev	The instrument configuration revision number	int32	10a0	4256	Not applicable
Instrument.Info.IM	Instrument mode Operating: All algorithms and I/O active. Standby: Control o/p off. Absolute alarms active Engineer: All outputs inactive.	uint8	00c7	199	Not applicable
Instrument.Info.LineVoltage	The current supply voltage (for PFF applications)	float32	10a6	4262	1dp
Instrument.Info.Name	The instrument descriptor	string_t	445f	17503	Not applicable
Instrument.Info.NvolWrites	Displays the number of non-volatile writes performed	int32	10a5	4261	Not applicable
Instrument.Info.SecurityRev	The instrument security revision number	int32	10a4	4260	Not applicable
Instrument.Info.Type	Shows instrument type	uint8	10a2	4258	Not applicable
Instrument.Info.Version	Shows instrument version	string_t	4474	17524	Not applicable
Instrument.Locale.DateFormat	Date format (0 = DDMMYY. 1 = MMDDYY; 2 = YYMMDD)	uint8	10b1	4273	Not applicable
Instrument.Locale.DSTenable	1 = Daylight Saving Time enabled	bool	10b3	4275	Not applicable
Instrument.Locale.EndDay	Daylight savings: End day 0 = Sunday 1= Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday	uint8	10ba	4282	Not applicable
Instrument.Locale.EndMonth	Daylight savings: End month 0 = January 1= February 2 = March 3 = April 4 = May 5 = June 6 = July 7 = August 8 = September 9 = October 10 = November 11 = December	uint8	10bb	4283	Not applicable
Instrument.Locale.EndOn	Week for changing to/from DST 0 = First 1= Second 2 = Third 3 = Fourth 4 = Last 5 = Second to last	uint8	10b9	4281	Not applicable
Instrument.Locale.EndTime	DST end time in hours, minutes, seconds and milliseconds	time_t	10b8	4280	Set by Network.Modbus.TimeFormat
Instrument.Locale.Language	Language (0 = English)	uint8	10b0	4272	Not applicable
Instrument.Locale.StartDay	DST start day. As Instrument.Locale.EndDay, above	uint8	10b6	4278	Not applicable
Instrument.Locale.StartMonth	DST start month As Instrument.Locale.EndMonth, above	uint8	10b7	4279	Not applicable
Instrument.Locale.StartOn	Start DST on. As Instrument.Locale.EndOn, above	uint8	10b5	4277	Not applicable
Instrument.Locale.StartTime	DST start time. As Instrument.Locale.EndTime above	time_t	10b4	4276	Set by Network.Modbus.TimeFormat
Instrument.Locale.TimeZone	Time zone 0 = GMT - 12 hours 1 = GMT - 11 hours 2 = GMT - 10 hours 3 = GMT - 9 hours 4 = GMT - 8 hours 5 = GMT - 7 hours 6 = GMT - 6 hours 7 = GMT - 5 hours 8 = GMT - 4 hours 9 = GMT - 3.5 hours 10 = GMT - 3 hours 11 = GMT - 2 hours 12 = GMT - 1 hour 13 = GMT 14 = GMT + 1 hour 15 = GMT + 2 hours 16 = GMT + 3 hours 17 = GMT + 3.5 hours 18 = GMT + 4 hours 19 = GMT + 4.5 hours 20 = GMT + 5 hours 21 = GMT + 5.5 hours 22 = GMT + 5.75 hours 23 = GMT + 6 hours 24 = GMT + 6.5 hours 25 = GMT + 7 hours 26 = GMT + 8 hours 27 = GMT + 9 hours 28 = GMT + 9.5 hours 29 = GMT + 10 hours 30 = GMT + 11 hours 31 = GMT + 12 hours 32 = GMT + 13 hours	uint8	10b2	4274	Not applicable
Instrument.Notes.Note	Operator Note	string_t	5500	21760	Not applicable
Instrument.Notes.Note1	Operator note 1	string_t	5580	21888	Not applicable
Instrument.Notes.Note2	Operator note 2	string_t	5600	22016	Not applicable
Instrument.Notes.Note3	Operator note 3	string_t	5680	22144	Not applicable
Instrument.Notes.Note4	Operator note 4	string_t	5700	22272	Not applicable
Instrument.Notes.Note5	Operator note 5	string_t	5780	22400	Not applicable
Instrument.Notes.Note6	Operator note 6	string_t	5800	22528	Not applicable
Instrument.Notes.Note7	Operator note 7	string_t	5880	22656	Not applicable
Instrument.Notes.Note8	Operator note 8	string_t	5900	22784	Not applicable
Instrument.Notes.Note9	Operator note 9	string_t	5980	22912	Not applicable
Instrument.Notes.Note10	Operator note 10	string_t	5a00	23040	Not applicable
Instrument.PromoteList.PromoteParam1	Promote parameter No. 1	eint32	10e0	4320	Not applicable
Instrument.PromoteList.PromoteParam1Desc	Descriptor for promote parameterNo. 1	string_t	6300	25344	Not applicable
Instrument.PromoteList.PromoteParam2	Promote parameter No. 2	eint32	10e1	4321	Not applicable
Instrument.PromoteList.PromoteParam2Desc	Descriptor for promote parameter No. 2	string_t	6315	25365	Not applicable
Instrument.PromoteList.PromoteParam3	Promote parameter No. 3	eint32	10e2	4322	Not applicable
Instrument.PromoteList.PromoteParam3Desc	Descriptor for promote parameter No. 3	string_t	632a	25386	Not applicable
Instrument.PromoteList.PromoteParam4	Promote parameter No. 4	eint32	10e3	4323	Not applicable
Instrument.PromoteList.PromoteParam4Desc	Descriptor for promote parameter No. 4	string_t	633f	25407	Not applicable
Instrument.PromoteList.PromoteParam5	Promote parameter No. 5	eint32	10e4	4324	Not applicable
Instrument.PromoteList.PromoteParam5Desc	Descriptor for promote parameter No. 5	string_t	6354	25428	Not applicable
Instrument.PromoteList.PromoteParam6	Promote parameter No. 6	eint32	10e5	4325	Not applicable
Instrument.PromoteList.PromoteParam6Desc	Descriptor for promote parameter No. 6	string_t	6369	25449	Not applicable
Instrument.PromoteList.PromoteParam7	Promote parameter No. 7	eint32	10e6	4326	Not applicable
Instrument.PromoteList.PromoteParam7Desc	Descriptor for promote parameterNo. 7	string_t	637e	25470	Not applicable
Instrument.PromoteList.PromoteParam8	Promote parameter No. 8	eint32	10e7	4327	Not applicable
Instrument.PromoteList.PromoteParam8Desc	Descriptor for promote parameter No. 8	string_t	6393	25491	Not applicable
Instrument.PromoteList.PromoteParam9	Promote parameter No. 9	eint32	10e8	4328	Not applicable
Instrument.PromoteList.PromoteParam9Desc	Descriptor for promote parameter No. 9	string_t	63a8	25512	Not applicable
Instrument.PromoteList.PromoteParam10	Promote parameter No. 10	eint32	10e9	4329	Not applicable
Instrument.PromoteList.PromoteParam10Desc	Descriptor for promote parameter No. 10	string_t	63bd	25533	Not applicable
Instrument.Security.CommsPass	1 = Password required for comms access	bool	10c1	4289	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Instrument.Security.DefaultConfig	1 = set all parameters to factory settings	bool	10c2	4290	Not applicable
Instrument.Security.EngineerAccess	1 = Engineer access required	bool	10c0	4288	Not applicable
Instrument.Security.EngineerPassword	Engineer pass phrase (default = 100)	string_t	63d3	25555	Not applicable
Instrument.Security.FeaturePass	Option enable code (manufacturer supplied)	int32	10c3	4291	Not applicable
Instrument.Security.OperatorPassword	Operator pass phrase (default = blank)	string_t	6437	25655	Not applicable
Instrument.Security.PassPhrase	The password required if 'CommsPass' = 1	string_t	444a	17482	Not applicable
Instrument.Security.SupervisorPassword	Supervisor pass phrase (default = blank)	string_t	6405	25605	Not applicable
Loop.1.Diag.DerivativeOutContrib	Derivative Output Contribution	float32	0212	530	0dp
Loop.1.Diag.Error	Calculated error	float32	020d	525	Same as Loop.1.Main.PV
Loop.1.Diag.IntegralOutContrib	Integral Output Contribution	float32	0211	529	0dp
Loop.1.Diag.LoopBreakAlarm	Loop Break (0 = No break; 1 = Break)	bool	020f	527	Not applicable
Loop.1.Diag.LoopMode	Mode of the Loop (0 = Auto; 1 = Man; 2 = Off)	uint8	1691	5777	Not applicable
Loop.1.Diag.PropOutContrib	Proportional Output Contribution	float32	0210	528	0dp
Loop.1.Diag.SBrk	Sensor Break Status (0 = No break; 1 = Break)	bool	0213	531	Not applicable
Loop.1.Diag.SchedCBH	The Scheduled Cutback High (0 = Auto)	float32	1695	5781	0dp
Loop.1.Diag.SchedCBL	The Scheduled Cutback Low (0 = Auto)	float32	1696	5782	0dp
Loop.1.Diag.SchedLPBrk	The Scheduled Loop Break Time	float32	1698	5784	0dp
Loop.1.Diag.SchedMR	The Scheduled Manual Reset	float32	1697	5783	1dp
Loop.1.Diag.SchedOPHi	The Scheduled Output High Limit	float32	169a	5786	1dp
Loop.1.Diag.SchedOPLo	The Scheduled Output Low Limit	float32	169b	5787	1dp
Loop.1.Diag.SchedPB	The Scheduled Proportional Band	float32	1692	5778	1dp
Loop.1.Diag.SchedR2G	The Scheduled Relative Cool Gain	float32	1699	5785	1dp
Loop.1.Diag.SchedTd	The Scheduled Derivative Time (0 = Off)	float32	1694	5780	0dp
Loop.1.Diag.SchedTi	The Scheduled Integral Time (0 = Off)	float32	1693	5779	0dp
Loop.1.Diag.TargetOutVal	Target Output value	float32	020e	526	Same as Loop.1.OP.OutputHighLimit
Loop.1.Diag.WrkOPHi	Working Output High Limit	float32	0215	533	0dp
Loop.1.Diag.WrkOPLo	Working Output Low Limit	float32	0214	532	0dp
Loop.1.Main.ActiveOut	Working Output	float32	0204	516	Same as Loop.1.OP.OutputHighLimit
Loop.1.Main.AutoMan	Auto/Manual Mode (0 = Auto; 1 = Man)	bool	0201	513	Not applicable
Loop.1.Main.Inhibit	Control Inhibit (0 = No; 1 = Yes)	bool	0205	517	Not applicable
Loop.1.Main.IntHold	Integral action inhibit. 0 = No; 1 = Yes	uint8	0206	518	Not applicable
Loop.1.Main.TargetSP	Target Setpoint	float32	0202	514	Same as Loop.1.Main.PV
Loop.1.Main.WorkingSP	Working Setpoint	float32	0203	515	Same as Loop.1.Main.PV
Loop.1.OP.Ch1OnOffHysteresis	Ch1 On/Off Hysteresis in Engineering Units	float32	1672	5746	Same as Loop.1.Main.PV
Loop.1.OP.Ch1Out	Channel 1 Output Value	float32	020b	523	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch1PotBreak	Ch1 Potentiometer Break (0 = Off; 1 = On)	uint8	1679	5753	Not applicable
Loop.1.OP.Ch1PotPosition	Ch1 Valve Position	float32	1678	5752	0dp
Loop.1.OP.Ch1TravelTime	Channel 1 Travel Time	float32	1674	5748	1dp
Loop.1.OP.Ch2Deadband	Channel 2 Deadband	float32	166f	5743	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch2OnOffHysteresis	Ch2 On/Off Hysteresis in Eng Units	float32	1673	5747	Same as Loop.1.Main.PV
Loop.1.OP.Ch2Out	Channel 2 (Cool) Output Value	float32	020c	524	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.Ch2PotBreak	Ch2 Potentiometer Break (0 = Off; 1 = On)	uint8	167b	5755	Not applicable
Loop.1.OP.Ch2PotPosition	Ch2 Valve Position	float32	167a	5754	0dp
Loop.1.OP.Ch2TravelTime	Channel 2 Travel Time	float32	1675	5749	1dp
Loop.1.OP.CoolType	Cooling Algorithm Type 0 = Linear 1 = Oil 2 = Water 3 = Fan	uint8	1683	5763	Not applicable
Loop.1.OP.EnablePowerFeedforward	0 = Power Feedforward disabled; 1 = PFF enabled	uint8	1681	5761	Not applicable
Loop.1.OP.FeedForwardGain	Feedforward Gain	float32	1685	5765	3dp
Loop.1.OP.FeedForwardOffset	Feedforward Offset	float32	1686	5766	0dp
Loop.1.OP.FeedForwardTrimLimit	Feedforward Trim Limit	float32	1687	5767	0dp
Loop.1.OP.FeedForwardType	Feedforward Type (0 = None; 1 = Remote; 2 = SP; 3 = PV)	uint8	1684	5764	Not applicable
Loop.1.OP.FeedForwardVal	Feedforward Value	float32	1688	5768	0dp
Loop.1.OP.FF_Rem	Remote Feed Forward Input	float32	168d	5773	0dp
Loop.1.OP.ForcedOP	Forced manual output value	float32	168f	5775	1dp
Loop.1.OP.ManStartup	Manual Startup Mode (0 = Off; 1 = On)	bool	1690	5776	Not applicable
Loop.1.OP.ManualMode	Manual Output Mode (0 = Track; 1 = Step; 2 = Last MOP)	uint8	167f	5759	Not applicable
Loop.1.OP.ManualOutVal	Manual Output Value	float32	1680	5760	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.MeasuredPower	Measured Mains Voltage	float32	1682	5762	0dp
Loop.1.OP.NudgeLower	Valve Nudge Lower (1 = Lower)	uint8	1677	5751	Not applicable
Loop.1.OP.NudgeRaise	Valve Nudge Raise (1 = Raise)	uint8	1676	5750	Not applicable
Loop.1.OP.OutputHighLimit	Output High Limit	float32	166d	5741	1dp
Loop.1.OP.OutputLowLimit	Output Low Limit	float32	166e	5742	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.PotBreakMode	Potentiometer Break Mode (0 = Raise; 1 = Lower; 2 = Rest: 3 = Model)	uint8	167c	5756	Not applicable
Loop.1.OP.PotCalibrate	Calibrate Potentiometer	uint8	f821	63521	Not applicable
Loop.1.OP.Rate	Output Rate Limit Value (0 = Off)	float32	1670	5744	1dp
Loop.1.OP.RateDisable	Output Rate Limit Disable (1 = Disabled)	bool	1671	5745	Not applicable
Loop.1.OP.RemOPH	Remote Output High Limit	float32	168c	5772	Same as Loop.1.Main.ActiveOut
Loop.1.OP.RemOPL	Remote Output Low Limit	float32	168b	5771	Same as Loop.1.Main.ActiveOut
Loop.1.OP.SafeOutVal	Safe Output Value	float32	167e	5758	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.SbrkOP	The output power in sensor break	float32	168e	5774	Same as Loop.1.OP.OutputHighLimit
Loop.1.OP.SensorBreakMode	Sensor Break Mode (0 = SbrkOP; 1 = Hold)	uint8	167d	5757	Not applicable
Loop.1.OP.TrackEnable	Enable Output Tracking (0 = Disabled; 1 = Enabled)	uint8	168a	5770	Not applicable
Loop.1.OP.TrackOutVal	Output Track Value	float32	1689	5769	0dp
Loop.1.PID.ActiveSet	Current PID Set	uint8	1638	5688	Not applicable
Loop.1.PID.Boundary1-2	Threshold for swapping between set 1 and set 2	float32	1639	5689	0dp
Loop.1.PID.Boundary2-3	Threshold for swapping between set 2 and set 3	float32	163a	5690	0dp
Loop.1.PID.CutbackHigh	Cutback high value for PID set 1 (0 = Auto)	float32	163f	5695	1dp
Loop.1.PID.CutbackHigh2	Cutback high value for PID set 2 (0 = Auto)	float32	1647	5703	1dp
Loop.1.PID.CutbackHigh3	Cutback high value for PID set 3 (0 = Auto)	float32	164f	5711	1dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.1.PID.CutbackLow	Cutback low value for PID set 1 (0 = Auto)	float32	1640	5696	1dp
Loop.1.PID.CutbackLow2	Cutback low value for PID set 2 (0 = Auto)	float32	1648	5704	1dp
Loop.1.PID.CutbackLow3	Cutback low value for PID set 3 (0 = Auto)	float32	1650	5712	1dp
Loop.1.PID.DerivativeTime	Derivative time for PID set 1	float32	163d	5693	0dp
Loop.1.PID.DerivativeTime2	Derivative time for PID set 2	float32	1645	5701	0dp
Loop.1.PID.DerivativeTime3	Derivative time for PID set 3	float32	164d	5709	0dp
Loop.1.PID.IntegralTime	Integral time for PID set 1	float32	163c	5692	0dp
Loop.1.PID.IntegralTime2	Integral time for PID set 2	float32	1644	5700	0dp
Loop.1.PID.IntegralTime3	Integral time for PID set 3	float32	164c	5708	0dp
Loop.1.PID.LoopBreakTime	Loop break time for PID set 1	float32	1642	5698	0dp
Loop.1.PID.LoopBreakTime2	Loop break time for PID set 2	float32	164a	5706	0dp
Loop.1.PID.LoopBreakTime3	Loop break time for PID set 3	float32	1652	5714	0dp
Loop.1.PID.ManualReset	Manual reset value for PID set 1	float32	1641	5697	1dp
Loop.1.PID.ManualReset2	Manual reset value for PID set 2	float32	1649	5705	1dp
Loop.1.PID.ManualReset3	Manual reset value for PID set 3	float32	1651	5713	1dp
Loop.1.PID.NumSets	Number of PID Sets to be used (max = 3)	uint8	1636	5686	Not applicable
Loop.1.PID.OutputHi	Gain scheduled output high limit for PID set 1	float32	1653	5715	1dp
Loop.1.PID.OutputHi2	Gain scheduled output high limit for PID set 2	float32	1655	5717	1dp
Loop.1.PID.OutputHi3	Gain scheduled output high limit for PID set 3	float32	1657	5719	1dp
Loop.1.PID.OutputLo	Gain scheduled output low limit for PID set 1	float32	1654	5716	1dp
Loop.1.PID.OutputLo2	Gain scheduled output low limit for PID set 2	float32	1656	5718	1dp
Loop.1.PID.OutputLo3	Gain scheduled output low limit for PID set 3	float32	1658	5720	1dp
Loop.1.PID.ProportionalBand	Proportional band value for PID set 1	float32	163b	5691	1dp
Loop.1.PID.ProportionalBand2	Proportional band value for PID set 2	float32	1643	5699	1dp
Loop.1.PID.ProportionalBand3	Proportional band value for PID set 3	float32	164b	5707	1dp
Loop.1.PID.RelCh2Gain	Channel 2 relative cool gain value for PID set 1	float32	163e	5694	1dp
Loop.1.PID.RelCh2Gain2	Channel 2 relative cool gain value for PID set 2	float32	1646	5702	1dp
Loop.1.PID.RelCh2Gain3	Channel 2 relative cool gain value for PID set 3	float32	164e	5710	1dp
Loop.1.PID.SchedulerRemoteInput	Scheduler Remote Input	float32	1637	5687	0dp
Loop.1.PID.SchedulerType	Scheduler Type 0 = Off 1 = Set 2 = SP 3 = PV 4 = Error 5 = OP 6 = Rem	uint8	1635	5685	Not applicable
Loop.1.Setup.AutoManAccess	Edit access to 'Auto Man' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	16a8	5800	Not applicable
Loop.1.Setup.CH1ControlType	Heat/Ch1 Control Type 0 =Off; 1 = On Off; 2 = PID; 3 = VPU; 4 = VPB	uint8	1601	5633	Not applicable
Loop.1.Setup.CH2ControlType	Channel 2 control type (As channel 1, above)	uint8	1602	5634	Not applicable
Loop.1.Setup.ControlAction	Control Action (0 = Reverse; 1 = Direct)	uint8	1603	5635	Not applicable
Loop.1.Setup.DerivativeType	Derivative Type (0 = PV; 1 = Error)	uint8	1605	5637	Not applicable
Loop.1.Setup.LoopName	Loop Name	string_t	5d00	23808	Not applicable
Loop.1.Setup.LoopType	Loop Type (0 = Single; 1 = Cascade; 2 = Override; 3 = Ratio)	uint8	1600	5632	Not applicable
Loop.1.Setup.PBUnits	Proportional Band Units	uint8	1604	5636	Not applicable
Loop.1.Setup.SPAccess	Edit access to 'SP' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	16a7	5799	Not applicable
Loop.1.SP.AltSP	Alternate Setpoint	float32	1660	5728	Same as Loop.1.Main.PV
Loop.1.SP.AltSPSelect	Alternate Setpoint Enable (0 = disable; 1 = enable)	uint8	1661	5729	Not applicable
Loop.1.SP.ManualTrack	Manual Track Enable (0 = disable; 1 = enable)	uint8	1667	5735	Not applicable
Loop.1.SP.RangeHigh	Setpoint Range High Limit	float32	1659	5721	Same as Loop.1.Main.PV
Loop.1.SP.RangeLow	Setpoimt Range Low Limit	float32	165a	5722	Same as Loop.1.Main.PV
Loop.1.SP.Rate	Setpoint Rate Limit Value (0 = Rate limit off)	float32	1662	5730	Same as Loop.1.Main.PV
Loop.1.SP.RateDisable	Setpoint Rate Limit Disable (0 = No; 1 = Yes)	bool	1663	5731	Not applicable
Loop.1.SP.RateDone	Setpoint Rate Limit Complete (0 = No; 1 = Yes)	bool	020a	522	Not applicable
Loop.1.SP.ServoToPV	Servo to PV Enable (0 = No; 1 = Yes)	bool	166c	5740	Not applicable
Loop.1.SP.SP1	Setpoint 1	float32	165c	5724	Same as Loop.1.Main.PV
Loop.1.SP.SP2	Setpoint 2	float32	165d	5725	Same as Loop.1.Main.PV
Loop.1.SP.SPHighLimit	Setpoint High Limit	float32	165e	5726	Same as Loop.1.Main.PV
Loop.1.SP.SPIntBal	SP Integral Balance (0 = Off; 1 = On)	bool	166b	5739	Not applicable
Loop.1.SP.SPLowLimit	Setpoint Low Limit	float32	165f	5727	Same as Loop.1.Main.PV
Loop.1.SP.SPSelect	Active Setpoint Select (0 = SP1; 1 = SP2)	uint8	165b	5723	Not applicable
Loop.1.SP.SPTrack	Enables setpoint tracking (0 = Off; 1 = On)	uint8	1668	5736	Not applicable
Loop.1.SP.SPTrim	Setpoint Trim value	float32	1664	5732	Same as Loop.1.Main.PV
Loop.1.SP.SPTrimHighLimit	Setpoint Trim High Limit	float32	1665	5733	Same as Loop.1.Main.PV
Loop.1.SP.SPTrimLowLimit	Setpoint Trim Low Limit	float32	1666	5734	Same as Loop.1.Main.PV
Loop.1.SP.TrackPV	PV for Programmer to Track	float32	1669	5737	Same as Loop.1.Main.PV
Loop.1.SP.TrackSP	Manual Tracking Value	float32	166a	5738	Same as Loop.1.Main.PV
Loop.1.Tune.AutotuneEnable	Autotune Enable (0 = Autotune Off; 1 = on)	bool	1631	5681	Not applicable
Loop.1.Tune.AutoTuneR2G	Enable Auto-Tune of R2G (0 = Yes; 1 = No)	uint8	1634	5684	Not applicable
Loop.1.Tune.OutputHighLimit	Autotune High Output Power Limit	float32	1632	5682	Same as Loop.1.OP.OutputHighLimit
Loop.1.Tune.OutputLowLimit	Autotune Low Output Power Limit	float32	1633	5683	Same as Loop.1.OP.OutputHighLimit
Loop.1.Tune.Stage	Autotune stage 0 = Reset 1 = None 2 = Monitor 3 = Current SP 4 = NewSP 5 = ToSp 6 = Max 7 = Min	uint8	0208	520	Not applicable
Loop.1.Tune.StageTime	Time in this Stage of Tune	float32	0209	521	0dp
Loop.1.Tune.State	Tune status 0 = Off 1 = Ready 2 = Complete 3 = Timeout 4 = Ti Lmit 5 = R2g limit	uint8	0207	519	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.1.Tune.StepSize	The output power step to be applied when performing a disturbance response autotune	float32	104f	4175	0dp
Loop.1.Tune.Type	Autotune Algorithm Type (0 = Cycle; 1 = Single; 2 = Adaptive)	uint8	1630	5680	Not applicable
Loop.2.Diag.DerivativeOutContrib	Derivative Output Contribution	float32	0292	658	0dp
Loop.2.Diag.Error	Calculated Error	float32	028d	653	Same as Loop.2.Main.PV
Loop.2.Diag.IntegralOutContrib	Integral Output Contribution	float32	0291	657	0dp
Loop.2.Diag.LoopBreakAlarm	Loop Break (0 = No break; 1 = Break)	bool	028f	655	Not applicable
Loop.2.Diag.LoopMode	Loop mode (0 = Auto; 1 = Man; 2 = Off)	uint8	1791	6033	Not applicable
Loop.2.Diag.PropOutContrib	Proportional Output Contribution	float32	0290	656	0dp
Loop.2.Diag.SBrk	Sensor break status (0 = No break; 1 = Break)	bool	0293	659	Not applicable
Loop.2.Diag.SchedCBH	The Scheduled Cutback Hi (0 = Auto)	float32	1795	6037	0dp
Loop.2.Diag.SchedCBL	The Scheduled Cutback Lo (0 = Auto)	float32	1796	6038	0dp
Loop.2.Diag.SchedLPBrk	The Scheduled Loop Break Time	float32	1798	6040	0dp
Loop.2.Diag.SchedMR	The Scheduled Manual Reset	float32	1797	6039	1dp
Loop.2.Diag.SchedOPHi	The Scheduled Output High Limit	float32	179a	6042	1dp
Loop.2.Diag.SchedOPLo	The Scheduled Output Low Limit	float32	179b	6043	1dp
Loop.2.Diag.SchedPB	The Scheduled Proportional Band	float32	1792	6034	1dp
Loop.2.Diag.SchedR2G	The Scheduled Relative Cool Gain	float32	1799	6041	1dp
Loop.2.Diag.SchedTd	The Scheduled Derivative Time (0 = Off)	float32	1794	6036	0dp
Loop.2.Diag.SchedTi	The Scheduled Integral Time (0 = Off)	float32	1793	6035	0dp
Loop.2.Diag.TargetOutVal	Target Output	float32	028e	654	Same as Loop.2.OP.OutputHighLimit
Loop.2.Diag.WrkOPHi	Working Output Hi Limit	float32	0295	661	0dp
Loop.2.Diag.WrkOPLo	Working Output Lo Limit	float32	0294	660	0dp
Loop.2.Main.ActiveOut	Working Output	float32	0284	644	Same as Loop.2.OP.OutputHighLimit
Loop.2.Main.AutoMan	Auto/Manual Mode (Mode. 0 = Auto; 1 = Man)	bool	0281	641	Not applicable
Loop.2.Main.Inhibit	Control Inhibit (0 = No; 1 = Yes)	bool	0285	645	Not applicable
Loop.2.Main.IntHold	Integral action inhibit. 0 = No; 1 = Yes	uint8	0286	646	Not applicable
Loop.2.Main.PV	Process Variable value	float32	0280	640	1dp
Loop.2.Main.TargetSP	Target Setpoint	float32	0282	642	Same as Loop.2.Main.PV
Loop.2.Main.WorkingSP	Working Setpoint	float32	0283	643	Same as Loop.2.Main.PV
Loop.2.OP.Ch1OnOffHysteresis	Channel 1 hysteresis in engineering units	float32	1772	6002	Same as Loop.2.Main.PV
Loop.2.OP.Ch1Out	Channel 1 Output Value	float32	028b	651	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch1PotBreak	Ch1 Potentiometer Break (0 = Off; 1 = On)	uint8	1779	6009	Not applicable
Loop.2.OP.Ch1PotPosition	Ch1 Valve Position	float32	1778	6008	0dp
Loop.2.OP.Ch1TravelTime	Channel 1 Travel Time	float32	1774	6004	1dp
Loop.2.OP.Ch2Deadband	Channel 2 Deadband	float32	176f	5999	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch2OnOffHysteresis	Channel 2 hysteresis in engineering units	float32	1773	6003	Same as Loop.2.Main.PV
Loop.2.OP.Ch2Out	Channel 2 output value	float32	028c	652	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.Ch2PotBreak	Channel 2 Potentiometer Break (0 = Off; 1 = On)	uint8	177b	6011	Not applicable
Loop.2.OP.Ch2PotPosition	Channel 2 Valve Position	float32	177a	6010	0dp
Loop.2.OP.Ch2TravelTime	Channel 2 Travel Time	float32	1775	6005	1dp
Loop.2.OP.CoolType	Cooling Algorithm Type 0 = Linear; 1 = Oil; 2 = Water; 3 = Fan	uint8	1783	6019	Not applicable
Loop.2.OP.EnablePowerFeedforward	0 = Power Feedforward disabled; 1 = PFF enabled	uint8	1781	6017	Not applicable
Loop.2.OP.FeedForwardGain	Feedforward Gain	float32	1785	6021	3dp
Loop.2.OP.FeedForwardOffset	Feedforward Offset	float32	1786	6022	0dp
Loop.2.OP.FeedForwardTrimLimit	Feedforward Trim Limit	float32	1787	6023	0dp
Loop.2.OP.FeedForwardType	Feedforward Type (0 = None; 1 = Remote; 2 = SP; 3 = PV)	uint8	1784	6020	Not applicable
Loop.2.OP.FeedForwardVal	Feedforward Value	float32	1788	6024	0dp
Loop.2.OP.FF_Rem	Remote Feed Forward Input	float32	178d	6029	0dp
Loop.2.OP.ForcedOP	Forced manual output value	float32	178f	6031	1dp
Loop.2.OP.ManStartup	Manual Startup Mode (0 = Off; 1 = On)	bool	1790	6032	Not applicable
Loop.2.OP.ManualMode	Manual Output Mode (0 = Track; 1 = Step; 2 = Last MOP)	uint8	177f	6015	Not applicable
Loop.2.OP.ManualOutVal	Manual Output Value	float32	1780	6016	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.MeasuredPower	Measured Mains Voltage	float32	1782	6018	0dp
Loop.2.OP.NudgeLower	Valve Nudge Lower (1 = Lower)	uint8	1777	6007	Not applicable
Loop.2.OP.NudgeRaise	Valve Nudge Raise (1 = Raise)	uint8	1776	6006	Not applicable
Loop.2.OP.OutputHighLimit	Output High Limit	float32	176d	5997	1dp
Loop.2.OP.OutputLowLimit	Output Low Limit	float32	176e	5998	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.PotBreakMode	Potentiometer Break Mode (0 = Raise; 1 = Lower; 2 = Rest; 3 = Model)	uint8	177c	6012	Not applicable
Loop.2.OP.Rate	Output Rate Limit Value (0 = off)	float32	1770	6000	1dp
Loop.2.OP.RateDisable	Output Rate Limit Disable (0 = No, 1 = Yes)	bool	1771	6001	Not applicable
Loop.2.OP.RemOPH	Remote Output High Limit	float32	178c	6028	Same as Loop.2.Main.ActiveOut
Loop.2.OP.RemOPL	Remote Output Low Limit	float32	178b	6027	Same as Loop.2.Main.ActiveOut
Loop.2.OP.SafeOutVal	Safe Output Value	float32	177e	6014	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.SbrkOP	The output power under sensor break conditions	float32	178e	6030	Same as Loop.2.OP.OutputHighLimit
Loop.2.OP.SensorBreakMode	Sensor Break Mode (0 = SbrkOP; 1 = Hold)	uint8	177d	6013	Not applicable
Loop.2.OP.TrackEnable	Enable Output Tracking (0 = Off; 1 = On)	uint8	178a	6026	Not applicable
Loop.2.OP.TrackOutVal	Output Track Value	float32	1789	6025	0dp
Loop.2.PID.ActiveSet	Current PID set	uint8	1738	5944	Not applicable
Loop.2.PID.Boundary1-2	Threshold for swapping between set 1 and set 2	float32	1739	5945	0dp
Loop.2.PID.Boundary2-3	Threshold for swapping between set 2 and set 3	float32	173a	5946	0dp
Loop.2.PID.CutbackHigh	Cutback high value for PID set 1 (0 = Auto)	float32	173f	5951	1dp
Loop.2.PID.CutbackHigh2	Cutback high value for PID set 2 (0 = Auto)	float32	1747	5959	1dp
Loop.2.PID.CutbackHigh3	Cutback high value for PID set 3 (0 = Auto)	float32	174f	5967	1dp
Loop.2.PID.CutbackLow	Cutback low value for PID set 1 (0 = Auto)	float32	1740	5952	1dp
Loop.2.PID.CutbackLow2	Cutback low value for PID set 2 (0 = Auto)	float32	1748	5960	1dp
Loop.2.PID.CutbackLow3	Cutback low value for PID set 3 (0 = Auto)	float32	1750	5968	1dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Loop.2.PID.DerivativeTime	Derivative time for PID set 1	float32	173d	5949	0dp
Loop.2.PID.DerivativeTime2	Derivative time for PID set 2	float32	1745	5957	0dp
Loop.2.PID.DerivativeTime3	Derivative time for PID set 3	float32	174d	5965	0dp
Loop.2.PID.IntegralTime	Integral time for PID set 1	float32	173c	5948	0dp
Loop.2.PID.IntegralTime2	Integral time for PID set 2	float32	1744	5956	0dp
Loop.2.PID.IntegralTime3	Integral time for PID set 3	float32	174c	5964	0dp
Loop.2.PID.LoopBreakTime	Loop break time for PID set 1	float32	1742	5954	0dp
Loop.2.PID.LoopBreakTime2	Loop break time for PID set 2	float32	174a	5962	0dp
Loop.2.PID.LoopBreakTime3	Loop break time for PID set 3	float32	1752	5970	0dp
Loop.2.PID.ManualReset	Manual reset value for PID set 1	float32	1741	5953	1dp
Loop.2.PID.ManualReset2	Manual reset value for PID set 2	float32	1749	5961	1dp
Loop.2.PID.ManualReset3	Manual reset value for PID set 3	float32	1751	5969	1dp
Loop.2.PID.NumSets	Number of PID sets to be used (max. 3)	uint8	1736	5942	Not applicable
Loop.2.PID.OutputHi	Gain scheduled output high limit for PID set 1	float32	1753	5971	1dp
Loop.2.PID.OutputHi2	Gain scheduled output high limit for PID set 2	float32	1755	5973	1dp
Loop.2.PID.OutputHi3	Gain scheduled output high limit for PID set 3	float32	1757	5975	1dp
Loop.2.PID.OutputLo	Gain scheduled output low limit for PID set 1	float32	1754	5972	1dp
Loop.2.PID.OutputLo2	Gain scheduled output low limit for PID set 2	float32	1756	5974	1dp
Loop.2.PID.OutputLo3	Gain scheduled output low limit for PID set 3	float32	1758	5976	1dp
Loop.2.PID.ProportionalBand	Proportional band value for PID set 1	float32	173b	5947	1dp
Loop.2.PID.ProportionalBand2	Proportional band value for PID set 2	float32	1743	5955	1dp
Loop.2.PID.ProportionalBand3	Proportional band value for PID set 3	float32	174b	5963	1dp
Loop.2.PID.RelCh2Gain	Channel 2 relative cool gain value for PID set 1	float32	173e	5950	1dp
Loop.2.PID.RelCh2Gain2	Channel 2 relative cool gain value for PID set 2	float32	1746	5958	1dp
Loop.2.PID.RelCh2Gain3	Channel 2 relative cool gain value for PID set 3	float32	174e	5966	1dp
Loop.2.PID.SchedulerRemoteInput	Scheduler Remote Input	float32	1737	5943	0dp
Loop.2.PID.SchedulerType	Scheduler Type 0 = Off 1 = Set 2 = SP 3 = PV 4 = Error 5 = OP 6 = Rem	uint8	1735	5941	Not applicable
Loop.2.Setup.AutoManAccess	Edit access to 'Auto Man' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	17a8	6056	Not applicable
Loop.2.Setup.CH1ControlType	Channel 1 Control Type 0 =Off; 1 = On Off; 2 = PID; 3 = VPU; 4 = VPB	uint8	1701	5889	Not applicable
Loop.2.Setup.CH2ControlType	Channel 2 Control Type (As channel 1, above)	uint8	1702	5890	Not applicable
Loop.2.Setup.ControlAction	Control Action (0 = Reverse; 1 = Direct)	uint8	1703	5891	Not applicable
Loop.2.Setup.DerivativeType	Derivative Type (0 = PV; 1 = Error)	uint8	1705	5893	Not applicable
Loop.2.Setup.LoopName	Loop Name	string_t	5d10	23824	Not applicable
Loop.2.Setup.LoopType	Loop Type (0 = single; 1 = cascade; 2 = override; 3 = ratio)	uint8	1700	5888	Not applicable
Loop.2.Setup.PBUnits	Proportional Band Units (0 = Engineering units; 1 = percent)	uint8	1704	5892	Not applicable
Loop.2.Setup.SPAccess	Edit access to 'SP' in Loop display page 0 = Read/Write (R/W) all modes 1 = Editable in all modes except 'Logged out' 2 = Editable only at Engineer and Supervisor levels	uint8	17a7	6055	Not applicable
Loop.2.SP.AltSP	Alternate Setpoint	float32	1760	5984	Same as Loop.2.Main.PV
Loop.2.SP.AltSPSelect	Select alternative setpoint (0 = No; 1 = Yes)	uint8	1761	5985	Not applicable
Loop.2.SP.ManualTrack	Manual Track Enable (0 = disable; 1 = enable)	uint8	1767	5991	Not applicable
Loop.2.SP.RangeHigh	Setpoint Range High Limit	float32	1759	5977	Same as Loop.2.Main.PV
Loop.2.SP.RangeLow	Setpoint Range Low Limit	float32	175a	5978	Same as Loop.2.Main.PV
Loop.2.SP.Rate	Setpoint Rate Limit Value (0 = Rate limit off)	float32	1762	5986	Same as Loop.2.Main.PV
Loop.2.SP.RateDisable	Setpoint Rate Limit Disable (0 = No; 1 = Yes)	bool	1763	5987	Not applicable
Loop.2.SP.RateDone	Setpoint Rate Limit Complete (0 = No; 1 = Yes)	bool	028a	650	Not applicable
Loop.2.SP.ServoToPV	Servo to PV Enable (0 = No; 1 = Yes)	bool	176c	5996	Not applicable
Loop.2.SP.SP1	Setpoint 1	float32	175c	5980	Same as Loop.2.Main.PV
Loop.2.SP.SP2	Setpoint 2	float32	175d	5981	Same as Loop.2.Main.PV
Loop.2.SP.SPHighLimit	Setpoint High Limit	float32	175e	5982	Same as Loop.2.Main.PV
Loop.2.SP.SPIntBal	SP Integral Balance (0 = Off; 1 = On)	bool	176b	5995	Not applicable
Loop.2.SP.SPLowLimit	Setpoint Low Limit	float32	175f	5983	Same as Loop.2.Main.PV
Loop.2.SP.SPSelect	Active Setpoint Select (0 = SP1; 1 = SP2)	uint8	175b	5979	Not applicable
Loop.2.SP.SPTrack	Enables setpoint tracking (0 = Off; 1 = On)	uint8	1768	5992	Not applicable
Loop.2.SP.SPTrim	Setpoint Trim	float32	1764	5988	Same as Loop.2.Main.PV
Loop.2.SP.SPTrimHighLimit	Setpoint Trim High Limit	float32	1765	5989	Same as Loop.2.Main.PV
Loop.2.SP.SPTrimLowLimit	Setpoint Trim Low Limit	float32	1766	5990	Same as Loop.2.Main.PV
Loop.2.SP.TrackPV	PV for Programmer to Track	float32	1769	5993	Same as Loop.2.Main.PV
Loop.2.SP.TrackSP	Manual Tracking Value	float32	176a	5994	Same as Loop.2.Main.PV
Loop.2.Tune.AutotuneEnable	Initiate autotune (0 = Autotune Off; 1 = on)	bool	1731	5937	Not applicable
Loop.2.Tune.AutoTuneR2G	Enable autotue of R2G (0 = Yes; 1 = No)	uint8	1734	5940	Not applicable
Loop.2.Tune.OutputHighLimit	Autotune High Output Power Limit	float32	1732	5938	Same as Loop.2.OP.OutputHighLimit
Loop.2.Tune.OutputLowLimit	Autotune Low Output Power Limit	float32	1733	5939	Same as Loop.2.OP.OutputHighLimit
Loop.2.Tune.Stage	Stage of Tune 0 = Reset 1 = None 2 = Monitor 3 = Current SP 4 = NewSP 5 = ToSp 6 = Max 7 = Min	uint8	0288	648	Not applicable
Loop.2.Tune.StageTime	Time in this Stage of Tune	float32	0289	649	0dp
Loop.2.Tune.State	Autotune state 0 = Off 1 = Ready 2 = Complete 3 = Timeout 4 = Ti Lmit 5 = R2g limit	uint8	0287	647	Not applicable
Loop.2.Tune.Type	Autotune Algorithm Type	uint8	1730	5936	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
nano_ui.Access	Access level 0 = Logged out; 1 = Operator; 2 = Supervisor; 3 = Engineer	uint8	2c00	11264	Not applicable
nano_ui.Password	Password	string_t	5400	21504	Not applicable
Network.Archive.ArchiveRate	Rate at which to archive history files 0 = None 1 = Every minute 2 = Hourly 3 = Daily 4 = Weekly 5 = Monthly 6 = Automatic	uint8	1114	4372	Not applicable
Network.Archive.CSVHeaders	Include header details (0 = No; 1 = Yes)	bool	111b	4379	Not applicable
Network.Archive.CSVHeadings	Include headings (0 = No; 1 = Yes)	bool	111c	4380	Not applicable
Network.Archive.CSVIncludeValues	Include process values (0 = No; 1 = Yes)	bool	1119	4377	Not applicable
Network.Archive.CSVMessages	Include messages (0 = No; 1 = Yes)	bool	111a	4378	Not applicable
Network.Archive.CSVTabDelimiter	Use Tab delimeter instead of comma (0 = No; 1 = Yes)	bool	111e	4382	Not applicable
Network.Archive.CVSDateFormat	Date/Time format (0 = Text; 1 = spreadsheet numeric)	uint8	111d	4381	Not applicable
Network.Archive.Destination	Archive destination. 0 = USB; 1 = FTP Server	uint8	1111	4369	Not applicable
Network.Archive.FileFormat	Archive file format (0 = Binary; 1 = CSV; 2 = both)	uint8	1115	4373	Not applicable
Network.Archive.MediaDuration	Time in days until the USB is full	float32	1118	4376	2dp
Network.Archive.MediaFree	Amount of unused USB memory remaining (MB)	float32	1120	4384	2dp
Network.Archive.MediaSize	The size of the USB memory	float32	1117	4375	2dp
Network.Archive.OnFull	Media full event strategy (0 = Overwrite; 1 = Stop archiving)	uint8	1116	4374	Not applicable
Network.Archive.Period	Period of history to be archived 0 = None 1 = last 60 mins 2 = last 24hrs 3 = last 7 days 4 = last 31 days 5 = all history 6 = all history since last archive	uint8	1155	4437	Not applicable
Network.Archive.PrimaryPassword	Primary FTP server password	string_t	6469	25705	Not applicable
Network.Archive.PrimaryUser	Primary FTP server username	string_t	45e6	17894	Not applicable
Network.Archive.PServerIPAddress	Primary FTP server IP address	string_t	45d4	17876	Not applicable
Network.Archive.RemotePath	The destination path for the archive files	string_t	456f	17775	Not applicable
Network.Archive.SecondaryPassword	Secondary FTP server password	string_t	64c3	25795	Not applicable
Network.Archive.SecondaryUser	Secondary FTP server username	string_t	464a	17994	Not applicable
Network.Archive.SServerIPAddress	Secondary FTP server IP address	string_t	4638	17976	Not applicable
Network.Archive.Trigger	Triggers an immediate demand archive	bool	1153	4435	Not applicable
Network.DemandArchive.LastWrittenOn	Last archive write date/time	string_t	4700	18176	Not applicable
Network.DemandArchive.PrimaryStatus	FTP Demand acrhive status (Primary server) 0 = Inactive 1 = Connecting 2 = Transferring 3 = Failed 4 = Complete	uint8	1150	4432	Not applicable
Network.DemandArchive.SecStatus	FTP Demand acrhive status (Secondary server) See PrimaryStatus (above)	uint8	1151	4433	Not applicable
Network.DemandArchive.Status	USB Demand archive status	uint8	1152	4434	Not applicable
Network.DemandArchive.SuspendSchedule	1 = Suspend scheduled archiving	bool	1154	4436	Not applicable
Network.FTPserver.Password	FTP Server account password	string_t	651d	25885	Not applicable
Network.FTPserver.Username	FTP Server account username	string_t	46ae	18094	Not applicable
Network.Interface.ClientIdentifier	DHCP option 21 Instrument ID	string_t	4715	18197	Not applicable
Network.Interface.Gateway	Default gateway internet protocol address	string_t	4524	17700	Not applicable
Network.Interface.IPaddress	Internet Protocol (IP) address of this instrument	string_t	4500	17664	Not applicable
Network.Interface.IPType	IP Lookup. 0 = DHCP, 1 = Fixed	uint8	1102	4354	Not applicable
Network.Interface.MAC	Media Access Control (MAC) address of this instrument	string_t	4548	17736	Not applicable
Network.Interface.SubnetMask	Sub network identification mask	string_t	4512	17682	Not applicable
Network.Modbus.Address	Modbus address for this instrument	uint8	1140	4416	Not applicable
Network.Modbus.InputTimeout	Modbus Input inactivity timeout (in seconds)	int16	1141	4417	Not applicable
Network.Modbus.PrefMasterIP	Preferred master IP	string_t	469c	18076	Not applicable
Network.Modbus.SerialMode	Modbus serial port mode	uint8	1143	4419	Not applicable
Network.Modbus.TimeFormat	Time parameter comms resolution	uint8	1144	4420	Not applicable
Network.Modbus.UnitIdEnable	Unit ident enable	uint8	1142	4418	Not applicable
OR.1.Input1	OR Block 1, input 1. 0 = off; 1 = on	bool	2d00	11520	Not applicable
OR.1.Input2	OR Block 1, input 2. 0 = off; 1 = on	bool	2d01	11521	Not applicable
OR.1.Input3	OR Block 1, input 3. 0 = off; 1 = on	bool	2d02	11522	Not applicable
OR.1.Input4	OR Block 1, input 4. 0 = off; 1 = on	bool	2d03	11523	Not applicable
OR.1.Input5	OR Block 1, input 5. 0 = off; 1 = on	bool	2d04	11524	Not applicable
OR.1.Input6	OR Block 1, input 6. 0 = off; 1 = on	bool	2d05	11525	Not applicable
OR.1.Input7	OR Block 1, input 7. 0 = off; 1 = on	bool	2d06	11526	Not applicable
OR.1.Input8	OR Block 1, input 8. 0 = off; 1 = on	bool	2d07	11527	Not applicable
OR.1.Output	OR Block 1, output. 0 = off; 1 = on	bool	2d08	11528	Not applicable
OR.2.Input1	OR Block 2, input 1. 0 = off; 1 = on	bool	2d10	11536	Not applicable
OR.2.Input2	OR Block 2, input 2. 0 = off; 1 = on	bool	2d11	11537	Not applicable
OR.2.Input3	OR Block 2, input 3. 0 = off; 1 = on	bool	2d12	11538	Not applicable
OR.2.Input4	OR Block 2, input 4. 0 = off; 1 = on	bool	2d13	11539	Not applicable
OR.2.Input5	OR Block 2, input 5. 0 = off; 1 = on	bool	2d14	11540	Not applicable
OR.2.Input6	OR Block 2, input 6. 0 = off; 1 = on	bool	2d15	11541	Not applicable
OR.2.Input7	OR Block 2, input 7. 0 = off; 1 = on	bool	2d16	11542	Not applicable
OR.2.Input8	OR Block 2, input 8. 0 = off; 1 = on	bool	2d17	11543	Not applicable
OR.2.Output	OR Block 1, output. 0 = off; 1 = on	bool	2d18	11544	Not applicable
OR.3.Input1	OR Block 3, input 1. 0 = off; 1 = on	bool	2d20	11552	Not applicable
OR.3.Input2	OR Block 3, input 2. 0 = off; 1 = on	bool	2d21	11553	Not applicable
OR.3.Input3	OR Block 3, input 3. 0 = off; 1 = on	bool	2d22	11554	Not applicable
OR.3.Input4	OR Block 3, input 4. 0 = off; 1 = on	bool	2d23	11555	Not applicable
OR.3.Input5	OR Block 3, input 5. 0 = off; 1 = on	bool	2d24	11556	Not applicable
OR.3.Input6	OR Block 3, input 6. 0 = off; 1 = on	bool	2d25	11557	Not applicable
OR.3.Input7	OR Block 3, input 7. 0 = off; 1 = on	bool	2d26	11558	Not applicable
OR.3.Input8	OR Block 3, input 8. 0 = off; 1 = on	bool	2d27	11559	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
OR.3.Output	OR Block 3, output. 0 = off; 1 = on	bool	2d28	11560	Not applicable
OR.4.Input1	OR Block 4, input 1. 0 = off; 1 = on	bool	2d30	11568	Not applicable
OR.4.Input2	OR Block 4, input 2. 0 = off; 1 = on	bool	2d31	11569	Not applicable
OR.4.Input3	OR Block 4, input 3. 0 = off; 1 = on	bool	2d32	11570	Not applicable
OR.4.Input4	OR Block 4, input 4. 0 = off; 1 = on	bool	2d33	11571	Not applicable
OR.4.Input5	OR Block 4, input 5. 0 = off; 1 = on	bool	2d34	11572	Not applicable
OR.4.Input6	OR Block 4, input 6. 0 = off; 1 = on	bool	2d35	11573	Not applicable
OR.4.Input7	OR Block 4, input 7. 0 = off; 1 = on	bool	2d36	11574	Not applicable
OR.4.Input8	OR Block 4, input 8. 0 = off; 1 = on	bool	2d37	11575	Not applicable
OR.4.Output	OR Block 4, output. 0 = off; 1 = on	bool	2d38	11576	Not applicable
OR.5.Input1	OR Block 5, input 1. 0 = off; 1 = on	bool	2d40	11584	Not applicable
OR.5.Input2	OR Block 5, input 2. 0 = off; 1 = on	bool	2d41	11585	Not applicable
OR.5.Input3	OR Block 5, input 3. 0 = off; 1 = on	bool	2d42	11586	Not applicable
OR.5.Input4	OR Block 5, input 4. 0 = off; 1 = on	bool	2d43	11587	Not applicable
OR.5.Input5	OR Block 5, input 5. 0 = off; 1 = on	bool	2d44	11588	Not applicable
OR.5.Input6	OR Block 5, input 6. 0 = off; 1 = on	bool	2d45	11589	Not applicable
OR.5.Input7	OR Block 5, input 7. 0 = off; 1 = on	bool	2d46	11590	Not applicable
OR.5.Input8	OR Block 5, input 8. 0 = off; 1 = on	bool	2d47	11591	Not applicable
OR.5.Output	OR Block 5, output. 0 = off; 1 = on	bool	2d48	11592	Not applicable
OR.6.Input1	OR Block 6, input 1. 0 = off; 1 = on	bool	2d50	11600	Not applicable
OR.6.Input2	OR Block 6, input 2. 0 = off; 1 = on	bool	2d51	11601	Not applicable
OR.6.Input3	OR Block 6, input 3. 0 = off; 1 = on	bool	2d52	11602	Not applicable
OR.6.Input4	OR Block 6, input 4. 0 = off; 1 = on	bool	2d53	11603	Not applicable
OR.6.Input5	OR Block 6, input 5. 0 = off; 1 = on	bool	2d54	11604	Not applicable
OR.6.Input6	OR Block 6, input 6. 0 = off; 1 = on	bool	2d55	11605	Not applicable
OR.6.Input7	OR Block 6, input 7. 0 = off; 1 = on	bool	2d56	11606	Not applicable
OR.6.Input8	OR Block 6, input 8. 0 = off; 1 = on	bool	2d57	11607	Not applicable
OR.6.Output	OR Block 6, output. 0 = off; 1 = on	bool	2d58	11608	Not applicable
OR.7.Input1	OR Block 7, input 1. 0 = off; 1 = on	bool	2d60	11616	Not applicable
OR.7.Input2	OR Block 7, input 2. 0 = off; 1 = on	bool	2d61	11617	Not applicable
OR.7.Input3	OR Block 7, input 3. 0 = off; 1 = on	bool	2d62	11618	Not applicable
OR.7.Input4	OR Block 7, input 4. 0 = off; 1 = on	bool	2d63	11619	Not applicable
OR.7.Input5	OR Block 7, input 5. 0 = off; 1 = on	bool	2d64	11620	Not applicable
OR.7.Input6	OR Block 7, input 6. 0 = off; 1 = on	bool	2d65	11621	Not applicable
OR.7.Input7	OR Block 7, input 7. 0 = off; 1 = on	bool	2d66	11622	Not applicable
OR.7.Input8	OR Block 7, input 8. 0 = off; 1 = on	bool	2d67	11623	Not applicable
OR.7.Output	OR Block 7, output. 0 = off; 1 = on	bool	2d68	11624	Not applicable
OR.8.Input1	OR Block 8, input 1. 0 = off; 1 = on	bool	2d70	11632	Not applicable
OR.8.Input2	OR Block 8, input 2. 0 = off; 1 = on	bool	2d71	11633	Not applicable
OR.8.Input3	OR Block 8, input 3. 0 = off; 1 = on	bool	2d72	11634	Not applicable
OR.8.Input4	OR Block 8, input 4. 0 = off; 1 = on	bool	2d73	11635	Not applicable
OR.8.Input5	OR Block 8, input 5. 0 = off; 1 = on	bool	2d74	11636	Not applicable
OR.8.Input6	OR Block 8, input 6. 0 = off; 1 = on	bool	2d75	11637	Not applicable
OR.8.Input7	OR Block 8, input 7. 0 = off; 1 = on	bool	2d76	11638	Not applicable
OR.8.Input8	OR Block 8, input 8. 0 = off; 1 = on	bool	2d77	11639	Not applicable
OR.8.Output	OR Block 8, output. 0 = off; 1 = on	bool	2d78	11640	Not applicable
OR.9.Input1	OR Block 9, input 1. 0 = off; 1 = on	bool	2d80	11648	Not applicable
OR.9.Input2	OR Block 9, input 2. 0 = off; 1 = on	bool	2d81	11649	Not applicable
OR.9.Input3	OR Block 9, input 3. 0 = off; 1 = on	bool	2d82	11650	Not applicable
OR.9.Input4	OR Block 9, input 4. 0 = off; 1 = on	bool	2d83	11651	Not applicable
OR.9.Input5	OR Block 9, input 5. 0 = off; 1 = on	bool	2d84	11652	Not applicable
OR.9.Input6	OR Block 9, input 6. 0 = off; 1 = on	bool	2d85	11653	Not applicable
OR.9.Input7	OR Block 9, input 7. 0 = off; 1 = on	bool	2d86	11654	Not applicable
OR.9.Input8	OR Block 9, input 8. 0 = off; 1 = on	bool	2d87	11655	Not applicable
OR.9.Output	OR Block 9, output. 0 = off; 1 = on	bool	2d88	11656	Not applicable
OR.10.Input1	OR Block 10, input 1. 0 = off; 1 = on	bool	2d90	11664	Not applicable
OR.10.Input2	OR Block 10, input 2. 0 = off; 1 = on	bool	2d91	11665	Not applicable
OR.10.Input3	OR Block 10, input 3. 0 = off; 1 = on	bool	2d92	11666	Not applicable
OR.10.Input4	OR Block 10, input 4. 0 = off; 1 = on	bool	2d93	11667	Not applicable
OR.10.Input5	OR Block 10, input 5. 0 = off; 1 = on	bool	2d94	11668	Not applicable
OR.10.Input6	OR Block 10, input 6. 0 = off; 1 = on	bool	2d95	11669	Not applicable
OR.10.Input7	OR Block 10, input 7. 0 = off; 1 = on	bool	2d96	11670	Not applicable
OR.10.Input8	OR Block 10, input 8. 0 = off; 1 = on	bool	2d97	11671	Not applicable
OR.10.Output	OR Block 10, output. 0 = off; 1 = on	bool	2d98	11672	Not applicable
OR.11.Input1	OR Block 11, input 1. 0 = off; 1 = on	bool	2da0	11680	Not applicable
OR.11.Input2	OR Block 11, input 2. 0 = off; 1 = on	bool	2da1	11681	Not applicable
OR.11.Input3	OR Block 11, input 3. 0 = off; 1 = on	bool	2da2	11682	Not applicable
OR.11.Input4	OR Block 11, input 4. 0 = off; 1 = on	bool	2da3	11683	Not applicable
OR.11.Input5	OR Block 11, input 5. 0 = off; 1 = on	bool	2da4	11684	Not applicable
OR.11.Input6	OR Block 11, input 6. 0 = off; 1 = on	bool	2da5	11685	Not applicable
OR.11.Input7	OR Block 11, input 7. 0 = off; 1 = on	bool	2da6	11686	Not applicable
OR.11.Input8	OR Block 11, input 8. 0 = off; 1 = on	bool	2da7	11687	Not applicable
OR.11.Output	OR Block 11, output. 0 = off; 1 = on	bool	2da8	11688	Not applicable
OR.12.Input1	OR Block 12, input 1. 0 = off; 1 = on	bool	2db0	11696	Not applicable
OR.12.Input2	OR Block 12, input 2. 0 = off; 1 = on	bool	2db1	11697	Not applicable
OR.12.Input3	OR Block 12, input 3. 0 = off; 1 = on	bool	2db2	11698	Not applicable
OR.12.Input4	OR Block 12, input 4. 0 = off; 1 = on	bool	2db3	11699	Not applicable
OR.12.Input5	OR Block 12, input 5. 0 = off; 1 = on	bool	2db4	11700	Not applicable
OR.12.Input6	OR Block 12, input 6. 0 = off; 1 = on	bool	2db5	11701	Not applicable
OR.12.Input7	OR Block 12, input 7. 0 = off; 1 = on	bool	2db6	11702	Not applicable
OR.12.Input8	OR Block 12, input 8. 0 = off; 1 = on	bool	2db7	11703	Not applicable
OR.12.Output	OR Block 12, output. 0 = off; 1 = on	bool	2db8	11704	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.1.NumberOfBreakpoints	Number of points in user linearisation table 1	uint8	2900	10496	Not applicable
UserLin.1.X1	User linearisation table 1 'X' value 1	float32	2901	10497	2dp
UserLin.1.X2	User linearisation table 1 'X' value 2	float32	2903	10499	2dp
UserLin.1.X3	User linearisation table 1 'X' value 3	float32	2905	10501	2dp
UserLin.1.X4	User linearisation table 1 'X' value 4	float32	2907	10503	2dp
UserLin.1.X5	User linearisation table 1 'X' value 5	float32	2909	10505	2dp
UserLin.1.X6	User linearisation table 1 'X' value 6	float32	290b	10507	2dp
UserLin.1.X7	User linearisation table 1 'X' value 7	float32	290d	10509	2dp
UserLin.1.X8	User linearisation table 1 'X' value 8	float32	290f	10511	2dp
UserLin.1.X9	User linearisation table 1 'X' value 9	float32	2911	10513	2dp
UserLin.1.X10	User linearisation table 1 'X' value 10	float32	2913	10515	2dp
UserLin.1.X11	User linearisation table 1 'X' value 11	float32	2915	10517	2dp
UserLin.1.X12	User linearisation table 1 'X' value 12	float32	2917	10519	2dp
UserLin.1.X13	User linearisation table 1 'X' value 13	float32	2919	10521	2dp
UserLin.1.X14	User linearisation table 1 'X' value 14	float32	291b	10523	2dp
UserLin.1.X15	User linearisation table 1 'X' value 15	float32	291d	10525	2dp
UserLin.1.X16	User linearisation table 1 'X' value 16	float32	291f	10527	2dp
UserLin.1.X17	User linearisation table 1 'X' value 17	float32	2921	10529	2dp
UserLin.1.X18	User linearisation table 1 'X' value 18	float32	2923	10531	2dp
UserLin.1.X19	User linearisation table 1 'X' value 19	float32	2925	10533	2dp
UserLin.1.X20	User linearisation table 1 'X' value 20	float32	2927	10535	2dp
UserLin.1.X21	User linearisation table 1 'X' value 21	float32	2929	10537	2dp
UserLin.1.X22	User linearisation table 1 'X' value 22	float32	292b	10539	2dp
UserLin.1.X23	User linearisation table 1 'X' value 23	float32	292d	10541	2dp
UserLin.1.X24	User linearisation table 1 'X' value 24	float32	292f	10543	2dp
UserLin.1.X25	User linearisation table 1 'X' value 25	float32	2931	10545	2dp
UserLin.1.X26	User linearisation table 1 'X' value 26	float32	2933	10547	2dp
UserLin.1.X27	User linearisation table 1 'X' value 27	float32	2935	10549	2dp
UserLin.1.X28	User linearisation table 1 'X' value 28	float32	2937	10551	2dp
UserLin.1.X29	User linearisation table 1 'X' value 29	float32	2939	10553	2dp
UserLin.1.X30	User linearisation table 1 'X' value 30	float32	293b	10555	2dp
UserLin.1.X31	User linearisation table 1 'X' value 31	float32	293d	10557	2dp
UserLin.1.X32	User linearisation table 1 'X' value 32	float32	293f	10559	2dp
UserLin.1.Y1	User linearisation table 1 'Y' value 1	float32	2902	10498	2dp
UserLin.1.Y2	User linearisation table 1 'Y' value 2	float32	2904	10500	2dp
UserLin.1.Y3	User linearisation table 1 'Y' value 3	float32	2906	10502	2dp
UserLin.1.Y4	User linearisation table 1 'Y' value 4	float32	2908	10504	2dp
UserLin.1.Y5	User linearisation table 1 'Y' value 5	float32	290a	10506	2dp
UserLin.1.Y6	User linearisation table 1 'Y' value 6	float32	290c	10508	2dp
UserLin.1.Y7	User linearisation table 1 'Y' value 7	float32	290e	10510	2dp
UserLin.1.Y8	User linearisation table 1 'Y' value 8	float32	2910	10512	2dp
UserLin.1.Y9	User linearisation table 1 'Y' value 9	float32	2912	10514	2dp
UserLin.1.Y10	User linearisation table 1 'Y' value 10	float32	2914	10516	2dp
UserLin.1.Y11	User linearisation table 1 'Y' value 11	float32	2916	10518	2dp
UserLin.1.Y12	User linearisation table 1 'Y' value 12	float32	2918	10520	2dp
UserLin.1.Y13	User linearisation table 1 'Y' value 13	float32	291a	10522	2dp
UserLin.1.Y14	User linearisation table 1 'Y' value 14	float32	291c	10524	2dp
UserLin.1.Y15	User linearisation table 1 'Y' value 15	float32	291e	10526	2dp
UserLin.1.Y16	User linearisation table 1 'Y' value 16	float32	2920	10528	2dp
UserLin.1.Y17	User linearisation table 1 'Y' value 17	float32	2922	10530	2dp
UserLin.1.Y18	User linearisation table 1 'Y' value 18	float32	2924	10532	2dp
UserLin.1.Y19	User linearisation table 1 'Y' value 19	float32	2926	10534	2dp
UserLin.1.Y20	User linearisation table 1 'Y' value 20	float32	2928	10536	2dp
UserLin.1.Y21	User linearisation table 1 'Y' value 21	float32	292a	10538	2dp
UserLin.1.Y22	User linearisation table 1 'Y' value 22	float32	292c	10540	2dp
UserLin.1.Y23	User linearisation table 1 'Y' value 23	float32	292e	10542	2dp
UserLin.1.Y24	User linearisation table 1 'Y' value 24	float32	2930	10544	2dp
UserLin.1.Y25	User linearisation table 1 'Y' value 25	float32	2932	10546	2dp
UserLin.1.Y26	User linearisation table 1 'Y' value 26	float32	2934	10548	2dp
UserLin.1.Y27	User linearisation table 1 'Y' value 27	float32	2936	10550	2dp
UserLin.1.Y28	User linearisation table 1 'Y' value 28	float32	2938	10552	2dp
UserLin.1.Y29	User linearisation table 1 'Y' value 29	float32	293a	10554	2dp
UserLin.1.Y30	User linearisation table 1 'Y' value 30	float32	293c	10556	2dp
UserLin.1.Y31	User linearisation table 1 'Y' value 31	float32	293e	10558	2dp
UserLin.1.Y32	User linearisation table 1 'Y' value 32	float32	2940	10560	2dp
UserLin.2.NumberOfBreakpoints	Number of points in user linearisation table 2	uint8	29c0	10688	Not applicable
UserLin.2.X1	User linearisation table 2 'X' value 1	float32	29c1	10689	2dp
UserLin.2.X2	User linearisation table 2 'X' value 2	float32	29c3	10691	2dp
UserLin.2.X3	User linearisation table 2 'X' value 3	float32	29c5	10693	2dp
UserLin.2.X4	User linearisation table 2 'X' value 4	float32	29c7	10695	2dp
UserLin.2.X5	User linearisation table 2 'X' value 5	float32	29c9	10697	2dp
UserLin.2.X6	User linearisation table 2 'X' value 6	float32	29cb	10699	2dp
UserLin.2.X7	User linearisation table 2 'X' value 7	float32	29cd	10701	2dp
UserLin.2.X8	User linearisation table 2 'X' value 8	float32	29cf	10703	2dp
UserLin.2.X9	User linearisation table 2 'X' value 9	float32	29d1	10705	2dp
UserLin.2.X10	User linearisation table 2 'X' value 10	float32	29d3	10707	2dp
UserLin.2.X11	User linearisation table 2 'X' value 11	float32	29d5	10709	2dp
UserLin.2.X12	User linearisation table 2 'X' value 12	float32	29d7	10711	2dp
UserLin.2.X13	User linearisation table 2 'X' value 13	float32	29d9	10713	2dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.2.X14	User linearisation table 2 'X' value 14	float32	29db	10715	2dp
UserLin.2.X15	User linearisation table 2 'X' value 15	float32	29dd	10717	2dp
UserLin.2.X16	User linearisation table 2 'X' value 16	float32	29df	10719	2dp
UserLin.2.X17	User linearisation table 2 'X' value 17	float32	29e1	10721	2dp
UserLin.2.X18	User linearisation table 2 'X' value 18	float32	29e3	10723	2dp
UserLin.2.X19	User linearisation table 2 'X' value 19	float32	29e5	10725	2dp
UserLin.2.X20	User linearisation table 2 'X' value 20	float32	29e7	10727	2dp
UserLin.2.X21	User linearisation table 2 'X' value 21	float32	29e9	10729	2dp
UserLin.2.X22	User linearisation table 2 'X' value 22	float32	29eb	10731	2dp
UserLin.2.X23	User linearisation table 2 'X' value 23	float32	29ed	10733	2dp
UserLin.2.X24	User linearisation table 2 'X' value 24	float32	29ef	10735	2dp
UserLin.2.X25	User linearisation table 2 'X' value 25	float32	29f1	10737	2dp
UserLin.2.X26	User linearisation table 2 'X' value 26	float32	29f3	10739	2dp
UserLin.2.X27	User linearisation table 2 'X' value 27	float32	29f5	10741	2dp
UserLin.2.X28	User linearisation table 2 'X' value 28	float32	29f7	10743	2dp
UserLin.2.X29	User linearisation table 2 'X' value 29	float32	29f9	10745	2dp
UserLin.2.X30	User linearisation table 2 'X' value 30	float32	29fb	10747	2dp
UserLin.2.X31	User linearisation table 2 'X' value 31	float32	29fd	10749	2dp
UserLin.2.X32	User linearisation table 2 'X' value 32	float32	29ff	10751	2dp
UserLin.2.Y1	User linearisation table 2 'Y' value 1	float32	29c2	10690	2dp
UserLin.2.Y2	User linearisation table 4 'Y' value 2	float32	29c4	10692	2dp
UserLin.2.Y3	User linearisation table 4 'Y' value 3	float32	29c6	10694	2dp
UserLin.2.Y4	User linearisation table 4 'Y' value 4	float32	29c8	10696	2dp
UserLin.2.Y5	User linearisation table 4 'Y' value 5	float32	29ca	10698	2dp
UserLin.2.Y6	User linearisation table 4 'Y' value 6	float32	29cc	10700	2dp
UserLin.2.Y7	User linearisation table 4 'Y' value 7	float32	29ce	10702	2dp
UserLin.2.Y8	User linearisation table 4 'Y' value 8	float32	29d0	10704	2dp
UserLin.2.Y9	User linearisation table 4 'Y' value 9	float32	29d2	10706	2dp
UserLin.2.Y10	User linearisation table 4 'Y' value 10	float32	29d4	10708	2dp
UserLin.2.Y11	User linearisation table 4 'Y' value 11	float32	29d6	10710	2dp
UserLin.2.Y12	User linearisation table 4 'Y' value 12	float32	29d8	10712	2dp
UserLin.2.Y13	User linearisation table 4 'Y' value 13	float32	29da	10714	2dp
UserLin.2.Y14	User linearisation table 4 'Y' value 14	float32	29dc	10716	2dp
UserLin.2.Y15	User linearisation table 4 'Y' value 15	float32	29de	10718	2dp
UserLin.2.Y16	User linearisation table 4 'Y' value 16	float32	29e0	10720	2dp
UserLin.2.Y17	User linearisation table 4 'Y' value 17	float32	29e2	10722	2dp
UserLin.2.Y18	User linearisation table 4 'Y' value 18	float32	29e4	10724	2dp
UserLin.2.Y19	User linearisation table 4 'Y' value 19	float32	29e6	10726	2dp
UserLin.2.Y20	User linearisation table 4 'Y' value 20	float32	29e8	10728	2dp
UserLin.2.Y21	User linearisation table 4 'Y' value 21	float32	29ea	10730	2dp
UserLin.2.Y22	User linearisation table 4 'Y' value 22	float32	29ec	10732	2dp
UserLin.2.Y23	User linearisation table 4 'Y' value 23	float32	29ee	10734	2dp
UserLin.2.Y24	User linearisation table 4 'Y' value 24	float32	29f0	10736	2dp
UserLin.2.Y25	User linearisation table 4 'Y' value 25	float32	29f2	10738	2dp
UserLin.2.Y26	User linearisation table 4 'Y' value 26	float32	29f4	10740	2dp
UserLin.2.Y27	User linearisation table 4 'Y' value 27	float32	29f6	10742	2dp
UserLin.2.Y28	User linearisation table 4 'Y' value 28	float32	29f8	10744	2dp
UserLin.2.Y29	User linearisation table 4 'Y' value 29	float32	29fa	10746	2dp
UserLin.2.Y30	User linearisation table 4 'Y' value 30	float32	29fc	10748	2dp
UserLin.2.Y31	User linearisation table 4 'Y' value 31	float32	29fe	10750	2dp
UserLin.2.Y32	User linearisation table 4 'Y' value 32	float32	2a00	10752	2dp
UserLin.3.NumberOfBreakpoints	Number of points in user linearisation table 32	uint8	2a80	10880	Not applicable
UserLin.3.X1	User linearisation table 3 'X' value 1	float32	2a81	10881	2dp
UserLin.3.X2	User linearisation table 3 'X' value 2	float32	2a83	10883	2dp
UserLin.3.X3	User linearisation table 3 'X' value 3	float32	2a85	10885	2dp
UserLin.3.X4	User linearisation table 3 'X' value 4	float32	2a87	10887	2dp
UserLin.3.X5	User linearisation table 3 'X' value 5	float32	2a89	10889	2dp
UserLin.3.X6	User linearisation table 3 'X' value 6	float32	2a8b	10891	2dp
UserLin.3.X7	User linearisation table 3 'X' value 7	float32	2a8d	10893	2dp
UserLin.3.X8	User linearisation table 3 'X' value 8	float32	2a8f	10895	2dp
UserLin.3.X9	User linearisation table 3 'X' value 9	float32	2a91	10897	2dp
UserLin.3.X10	User linearisation table 3 'X' value 10	float32	2a93	10899	2dp
UserLin.3.X11	User linearisation table 3 'X' value 11	float32	2a95	10901	2dp
UserLin.3.X12	User linearisation table 3 'X' value 12	float32	2a97	10903	2dp
UserLin.3.X13	User linearisation table 3 'X' value 13	float32	2a99	10905	2dp
UserLin.3.X14	User linearisation table 3 'X' value 14	float32	2a9b	10907	2dp
UserLin.3.X15	User linearisation table 3 'X' value 15	float32	2a9d	10909	2dp
UserLin.3.X16	User linearisation table 3 'X' value 16	float32	2a9f	10911	2dp
UserLin.3.X17	User linearisation table 3 'X' value 17	float32	2aa1	10913	2dp
UserLin.3.X18	User linearisation table 3 'X' value 18	float32	2aa3	10915	2dp
UserLin.3.X19	User linearisation table 3 'X' value 19	float32	2aa5	10917	2dp
UserLin.3.X20	User linearisation table 3 'X' value 20	float32	2aa7	10919	2dp
UserLin.3.X21	User linearisation table 3 'X' value 21	float32	2aa9	10921	2dp
UserLin.3.X22	User linearisation table 3 'X' value 22	float32	2aab	10923	2dp
UserLin.3.X23	User linearisation table 3 'X' value 23	float32	2aad	10925	2dp
UserLin.3.X24	User linearisation table 3 'X' value 24	float32	2aaf	10927	2dp
UserLin.3.X25	User linearisation table 3 'X' value 25	float32	2ab1	10929	2dp
UserLin.3.X26	User linearisation table 3 'X' value 26	float32	2ab3	10931	2dp
UserLin.3.X27	User linearisation table 3 'X' value 27	float32	2ab5	10933	2dp
UserLin.3.X28	User linearisation table 3 'X' value 28	float32	2ab7	10935	2dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.3.X29	User linearisation table 3 'X' value 29	float32	2ab9	10937	2dp
UserLin.3.X30	User linearisation table 3 'X' value 30	float32	2abb	10939	2dp
UserLin.3.X31	User linearisation table 3 'X' value 31	float32	2abd	10941	2dp
UserLin.3.X32	User linearisation table 3 'X' value 32	float32	2abf	10943	2dp
UserLin.3.Y1	User linearisation table 4 'Y' value 1	float32	2a82	10882	2dp
UserLin.3.Y2	User linearisation table 4 'Y' value 2	float32	2a84	10884	2dp
UserLin.3.Y3	User linearisation table 4 'Y' value 3	float32	2a86	10886	2dp
UserLin.3.Y4	User linearisation table 4 'Y' value 4	float32	2a88	10888	2dp
UserLin.3.Y5	User linearisation table 4 'Y' value 5	float32	2a8a	10890	2dp
UserLin.3.Y6	User linearisation table 4 'Y' value 6	float32	2a8c	10892	2dp
UserLin.3.Y7	User linearisation table 4 'Y' value 7	float32	2a8e	10894	2dp
UserLin.3.Y8	User linearisation table 4 'Y' value 8	float32	2a90	10896	2dp
UserLin.3.Y9	User linearisation table 4 'Y' value 9	float32	2a92	10898	2dp
UserLin.3.Y10	User linearisation table 4 'Y' value 10	float32	2a94	10900	2dp
UserLin.3.Y11	User linearisation table 4 'Y' value 11	float32	2a96	10902	2dp
UserLin.3.Y12	User linearisation table 4 'Y' value 12	float32	2a98	10904	2dp
UserLin.3.Y13	User linearisation table 4 'Y' value 13	float32	2a9a	10906	2dp
UserLin.3.Y14	User linearisation table 4 'Y' value 14	float32	2a9c	10908	2dp
UserLin.3.Y15	User linearisation table 4 'Y' value 15	float32	2a9e	10910	2dp
UserLin.3.Y16	User linearisation table 4 'Y' value 16	float32	2aa0	10912	2dp
UserLin.3.Y17	User linearisation table 4 'Y' value 17	float32	2aa2	10914	2dp
UserLin.3.Y18	User linearisation table 4 'Y' value 18	float32	2aa4	10916	2dp
UserLin.3.Y19	User linearisation table 4 'Y' value 19	float32	2aa6	10918	2dp
UserLin.3.Y20	User linearisation table 4 'Y' value 20	float32	2aa8	10920	2dp
UserLin.3.Y21	User linearisation table 4 'Y' value 21	float32	2aaa	10922	2dp
UserLin.3.Y22	User linearisation table 4 'Y' value 22	float32	2aac	10924	2dp
UserLin.3.Y23	User linearisation table 4 'Y' value 23	float32	2aae	10926	2dp
UserLin.3.Y24	User linearisation table 4 'Y' value 24	float32	2ab0	10928	2dp
UserLin.3.Y25	User linearisation table 4 'Y' value 25	float32	2ab2	10930	2dp
UserLin.3.Y26	User linearisation table 4 'Y' value 26	float32	2ab4	10932	2dp
UserLin.3.Y27	User linearisation table 4 'Y' value 27	float32	2ab6	10934	2dp
UserLin.3.Y28	User linearisation table 4 'Y' value 28	float32	2ab8	10936	2dp
UserLin.3.Y29	User linearisation table 4 'Y' value 29	float32	2aba	10938	2dp
UserLin.3.Y30	User linearisation table 4 'Y' value 30	float32	2abc	10940	2dp
UserLin.3.Y31	User linearisation table 4 'Y' value 31	float32	2abe	10942	2dp
UserLin.3.Y32	User linearisation table 4 'Y' value 32	float32	2ac0	10944	2dp
UserLin.4.NumberOfBreakpoints	Number of points in user linearisation table 4	uint8	2b40	11072	Not applicable
UserLin.4.X1	User linearisation table 4 'X' value 1	float32	2b41	11073	2dp
UserLin.4.X2	User linearisation table 4 'X' value 2	float32	2b43	11075	2dp
UserLin.4.X3	User linearisation table 4 'X' value 3	float32	2b45	11077	2dp
UserLin.4.X4	User linearisation table 4 'X' value 4	float32	2b47	11079	2dp
UserLin.4.X5	User linearisation table 4 'X' value v5	float32	2b49	11081	2dp
UserLin.4.X6	User linearisation table 4 'X' value 6	float32	2b4b	11083	2dp
UserLin.4.X7	User linearisation table 4 'X' value 7	float32	2b4d	11085	2dp
UserLin.4.X8	User linearisation table 4 'X' value 8	float32	2b4f	11087	2dp
UserLin.4.X9	User linearisation table 4 'X' value 9	float32	2b51	11089	2dp
UserLin.4.X10	User linearisation table 4 'X' value 10	float32	2b53	11091	2dp
UserLin.4.X11	User linearisation table 4 'X' value 11	float32	2b55	11093	2dp
UserLin.4.X12	User linearisation table 4 'X' value 12	float32	2b57	11095	2dp
UserLin.4.X13	User linearisation table 4 'X' value 13	float32	2b59	11097	2dp
UserLin.4.X14	User linearisation table 4 'X' value 14	float32	2b5b	11099	2dp
UserLin.4.X15	User linearisation table 4 'X' value 15	float32	2b5d	11101	2dp
UserLin.4.X16	User linearisation table 4 'X' value 16	float32	2b5f	11103	2dp
UserLin.4.X17	User linearisation table 4 'X' value 17	float32	2b61	11105	2dp
UserLin.4.X18	User linearisation table 4 'X' value 18	float32	2b63	11107	2dp
UserLin.4.X19	User linearisation table 4 'X' value 19	float32	2b65	11109	2dp
UserLin.4.X20	User linearisation table 4 'X' value 20	float32	2b67	11111	2dp
UserLin.4.X21	User linearisation table 4 'X' value 21	float32	2b69	11113	2dp
UserLin.4.X22	User linearisation table 4 'X' value 22	float32	2b6b	11115	2dp
UserLin.4.X23	User linearisation table 4 'X' value 23	float32	2b6d	11117	2dp
UserLin.4.X24	User linearisation table 4 'X' value 24	float32	2b6f	11119	2dp
UserLin.4.X25	User linearisation table 4 'X' value 25	float32	2b71	11121	2dp
UserLin.4.X26	User linearisation table 4 'X' value 26	float32	2b73	11123	2dp
UserLin.4.X27	User linearisation table 4 'X' value 27	float32	2b75	11125	2dp
UserLin.4.X28	User linearisation table 4 'X' value 28	float32	2b77	11127	2dp
UserLin.4.X29	User linearisation table 4 'X' value 29	float32	2b79	11129	2dp
UserLin.4.X30	User linearisation table 4 'X' value 30	float32	2b7b	11131	2dp
UserLin.4.X31	User linearisation table 4 'X' value 31	float32	2b7d	11133	2dp
UserLin.4.X32	User linearisation table 4 'X' value 32	float32	2b7f	11135	2dp
UserLin.4.Y1	User linearisation table 4 'Y' value 1	float32	2b42	11074	2dp
UserLin.4.Y2	User linearisation table 4 'Y' value 2	float32	2b44	11076	2dp
UserLin.4.Y3	User linearisation table 4 'Y' value 3	float32	2b46	11078	2dp
UserLin.4.Y4	User linearisation table 4 'Y' value 4	float32	2b48	11080	2dp
UserLin.4.Y5	User linearisation table 4 'Y' value 5	float32	2b4a	11082	2dp
UserLin.4.Y6	User linearisation table 4 'Y' value 6	float32	2b4c	11084	2dp
UserLin.4.Y7	User linearisation table 4 'Y' value 7	float32	2b4e	11086	2dp
UserLin.4.Y8	User linearisation table 4 'Y' value 8	float32	2b50	11088	2dp
UserLin.4.Y9	User linearisation table 4 'Y' value 9	float32	2b52	11090	2dp
UserLin.4.Y10	User linearisation table 4 'Y' value 10	float32	2b54	11092	2dp
UserLin.4.Y11	User linearisation table 4 'Y' value 11	float32	2b56	11094	2dp

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
UserLin.4.Y12	User linearisation table 4 'Y' value 12	float32	2b58	11096	2dp
UserLin.4.Y13	User linearisation table 4 'Y' value 13	float32	2b5a	11098	2dp
UserLin.4.Y14	User linearisation table 4 'Y' value 14	float32	2b5c	11100	2dp
UserLin.4.Y15	User linearisation table 4 'Y' value 15	float32	2b5e	11102	2dp
UserLin.4.Y16	User linearisation table 4 'Y' value 16	float32	2b60	11104	2dp
UserLin.4.Y17	User linearisation table 4 'Y' value 17	float32	2b62	11106	2dp
UserLin.4.Y18	User linearisation table 4 'Y' value 18	float32	2b64	11108	2dp
UserLin.4.Y19	User linearisation table 4 'Y' value 19	float32	2b66	11110	2dp
UserLin.4.Y20	User linearisation table 4 'Y' value 20	float32	2b68	11112	2dp
UserLin.4.Y21	User linearisation table 4 'Y' value 21	float32	2b6a	11114	2dp
UserLin.4.Y22	User linearisation table 4 'Y' value 22	float32	2b6c	11116	2dp
UserLin.4.Y23	User linearisation table 4 'Y' value 23	float32	2b6e	11118	2dp
UserLin.4.Y24	User linearisation table 4 'Y' value 24	float32	2b70	11120	2dp
UserLin.4.Y25	User linearisation table 4 'Y' value 25	float32	2b72	11122	2dp
UserLin.4.Y26	User linearisation table 4 'Y' value 26	float32	2b74	11124	2dp
UserLin.4.Y27	User linearisation table 4 'Y' value 27	float32	2b76	11126	2dp
UserLin.4.Y28	User linearisation table 4 'Y' value 28	float32	2b78	11128	2dp
UserLin.4.Y29	User linearisation table 4 'Y' value 29	float32	2b7a	11130	2dp
UserLin.4.Y30	User linearisation table 4 'Y' value 30	float32	2b7c	11132	2dp
UserLin.4.Y31	User linearisation table 4 'Y' value 31	float32	2b7e	11134	2dp
UserLin.4.Y32	User linearisation table 4 'Y' value 32	float32	2b80	11136	2dp
VirtualChannel.1.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c0	448	Not applicable
VirtualChannel.1.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1c50	7248	Not applicable
VirtualChannel.1.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1c4b	7243	Not applicable
VirtualChannel.1.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1c48	7240	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1c4a	7242	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1c42	7234	Not applicable
VirtualChannel.1.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1c49	7241	Not applicable
VirtualChannel.1.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1c47	7239	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Dwell	Alarm dwell time	time_t	1c45	7237	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm1.Hysteresis	Alarm hysteresis value	float32	1c44	7236	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1c4e	7246	Not applicable
VirtualChannel.1.Alarm1.Latch	Alarm latch type (0 = None; 1 = Auto; 2 = Manual; 3 = Trigger	uint8	1c41	7233	Not applicable
VirtualChannel.1.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1c4f	7247	Not applicable
VirtualChannel.1.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1c46	7238	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Status	Indication of the active and acknowledge status 0 = Unacknowledged 1 = None 2 = Active 3 = Inactive 4 = Acknowledged	uint8	0122	290	Not applicable
VirtualChannel.1.Alarm1.Threshold	Alarm trigger threshold	float32	1c43	7235	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm1.Type	Alarm type 0 = None 1 = Abs High 2 = Abs Low 3 = Dev high 4 = Dev Low 5 = Dev band 6 = ROC rising 7 = ROC falling 10 = Dig Off 11 = Dig High 12 = Dig Low	uint8	1c40	7232	Not applicable
VirtualChannel.1.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c1	449	Not applicable
VirtualChannel.1.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1c70	7280	Not applicable
VirtualChannel.1.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1c6b	7275	Not applicable
VirtualChannel.1.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1c68	7272	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1c6a	7274	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1c62	7266	Not applicable
VirtualChannel.1.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time	uint8	1c69	7273	Not applicable
VirtualChannel.1.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1c67	7271	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Dwell	Alarm dwell time	time_t	1c65	7269	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Alarm2.Hysteresis	Alarm hysteresis value	float32	1c64	7268	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1c6e	7278	Not applicable
VirtualChannel.1.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1c61	7265	Not applicable
VirtualChannel.1.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1c6f	7279	Not applicable
VirtualChannel.1.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1c66	7270	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0123	291	Not applicable
VirtualChannel.1.Alarm2.Threshold	Alarm trigger threshold	float32	1c63	7267	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1c60	7264	Not applicable
VirtualChannel.1.Main.Descriptor	Virtual Channel descriptor	string_t	4b00	19200	Not applicable
VirtualChannel.1.Main.Disable	1 = Virtual channel disabled	bool	1c23	7203	Not applicable
VirtualChannel.1.Main.HighCutOff	High cut off value for totalisers and counters	float32	1c05	7173	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Input1	Input 1 value	float32	1c07	7175	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Input2	Input 2 value	float32	1c08	7176	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.LowCutOff	Low cutoff value for totalisers and counters	float32	1c04	7172	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.ModbusInput	Modbus input value	float32	1c06	7174	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Operation	Specifies the operation of the virtual channel 0 = Off 2 = Add 3 = Subtract 4 = Multiply 5 = Divide 6 = Group avg 7 = Group min 8 = Group max 9 = Modbus i/p 11 = Copy 20 = Grp min latch 21 = Grp max latch 34 = Chan max 35 = Chan min 36 = Chan avg 43 = Config rev 64 = Off 65 = On 80 = Off 81 = On	uint8	1c01	7169	Not applicable
VirtualChannel.1.Main.Period	The time period over which the calculation is made	int32	1c0a	7178	Not applicable
VirtualChannel.1.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1c0c	7180	Not applicable
VirtualChannel.1.Main.PresetValue	The preset value	float32	1c0d	7181	Set by VirtualChannel.1.Main.Resolution

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.1.Main.PV	The virtual channel output value	float32	0120	288	Set by VirtualChannel.1.Main.Resolution
VirtualChannel.1.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1c0b	7179	Not applicable
VirtualChannel.1.Main.Resolution	Number of decimal places (0 to 6)	uint8	1c02	7170	Not applicable
VirtualChannel.1.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1c11	7185	Not applicable
VirtualChannel.1.Main.Status	Virtual Channel output status 0 =Good 1 = Off 2 = Over range 3 = Under range 4 = HW error 5 = Ranging 6 = Overflow 7 = bad 8 = HW exceeded 9 = No data 12 = Comms channel error	uint8	0121	289	Not applicable
VirtualChannel.1.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1c09	7177	Set by Network.Modbus.TimeFormat
VirtualChannel.1.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1c0e	7182	Not applicable
VirtualChannel.1.Main.Type	Specifies the type of virtual channel 1 = Maths; 2 = Totaliser; 3 = Counter	uint8	1c00	7168	Not applicable
VirtualChannel.1.Main.Units	Units descriptor	string_t	4b15	19221	Not applicable
VirtualChannel.1.Main.UnitsScaler	Units scaler for totalisers	float32	1c03	7171	1dpVirtualChannel.1.Trend.ColourCon-figures the trend colour for this virtual channeluint81c207200Not applicable
	0 = Red 1 = Blue 2 = Green 3 = Honey 4 = Violet 5 = Russet 6 = Dark blue 7 = Jade 8 = Magenta 9 = Dusky rose 10 = Yellow 11 = Powder blue 12 = Dark red 13 = Avocado 14 = Indigo 15 = Dark brown 16 = Aegean 17 = Cyan 18 = Aubergine 19 = Dark orange 20 = Pale yellow 21 = Hyacinth 22 = Dark green 23 = Sugar pink 24 = Bluebell 25 = Orange 26 = Pink 27 = Buttersilk 28 = Terracotta 29 = Blue babe 30 = Lime 31 = Blue jive 32 = Cucumber 33 = Eurogreen 34 = Wheatgerm 35 = Sea Blue 36 = Ginger 37 = Aqua pool 38 = Pale red 39 = Pale blue 40 = Lilac 41 = Sky blue 42 = Wild moss 43 = Turquoise 44 = Pale green 45 = Coffee 49 = Dark Grey 53 = Light grey				
VirtualChannel.1.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1c22	7202	Same as VirtualChannel.1.Main.PV
VirtualChannel.1.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1c21	7201	Same as VirtualChannel.1.Main.PV
VirtualChannel.2.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c2	450	Not applicable
VirtualChannel.2.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1cd0	7376	Not applicable
VirtualChannel.2.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1ccb	7371	Not applicable
VirtualChannel.2.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1cc8	7368	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1cca	7370	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1cc2	7362	Not applicable
VirtualChannel.2.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1cc9	7369	Not applicable
VirtualChannel.2.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1cc7	7367	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Dwell	Alarm dwell time	time_t	1cc5	7365	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm1.Hysteresis	Alarm hysteresis value	float32	1cc4	7364	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1cce	7374	Not applicable
VirtualChannel.2.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1cc1	7361	Not applicable
VirtualChannel.2.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1ccf	7375	Not applicable
VirtualChannel.2.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1cc6	7366	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0126	294	Not applicable
VirtualChannel.2.Alarm1.Threshold	Alarm trigger threshold	float32	1cc3	7363	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1cc0	7360	Not applicable
VirtualChannel.2.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c3	451	Not applicable
VirtualChannel.2.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1cf0	7408	Not applicable
VirtualChannel.2.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1ceb	7403	Not applicable
VirtualChannel.2.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1ce8	7400	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1cea	7402	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ce2	7394	Not applicable
VirtualChannel.2.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ce9	7401	Not applicable
VirtualChannel.2.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1ce7	7399	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Dwell	Alarm dwell time	time_t	1ce5	7397	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Alarm2.Hysteresis	Alarm hysteresis value	float32	1ce4	7396	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1cee	7406	Not applicable
VirtualChannel.2.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ce1	7393	Not applicable
VirtualChannel.2.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1cef	7407	Not applicable
VirtualChannel.2.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1ce6	7398	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0127	295	Not applicable
VirtualChannel.2.Alarm2.Threshold	Alarm trigger threshold	float32	1ce3	7395	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1ce0	7392	Not applicable
VirtualChannel.2.Main.Descriptor	Virtual Channel descriptor	string_t	4b1b	19227	Not applicable
VirtualChannel.2.Main.Disable	1 = Virtual channel disabled	bool	1ca3	7331	Not applicable
VirtualChannel.2.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1c85	7301	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Input1	Input 1 value	float32	1c87	7303	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Input2	Input 2 value	float32	1c88	7304	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1c84	7300	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.ModbusInput	Modbus input value	float32	1c86	7302	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1c81	7297	Not applicable
VirtualChannel.2.Main.Period	The time period over which the calculation is made	int32	1c8a	7306	Not applicable
VirtualChannel.2.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1c8c	7308	Not applicable
VirtualChannel.2.Main.PresetValue	The Preset value	float32	1c8d	7309	Set by VirtualChannel.2.Main.Resolution

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.2.Main.PV	The virtual channel output value	float32	0124	292	Set by VirtualChannel.2.Main.Resolution
VirtualChannel.2.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1c8b	7307	Not applicable
VirtualChannel.2.Main.Resolution	Specifies the resolution/number of decimal places	uint8	1c82	7298	Not applicable
VirtualChannel.2.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1c91	7313	Not applicable
VirtualChannel.2.Main.Status	As VirtualChannel1.Main.Status	uint8	0125	293	Not applicable
VirtualChannel.2.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1c89	7305	Set by Network.Modbus.TimeFormat
VirtualChannel.2.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1c8e	7310	Not applicable
VirtualChannel.2.Main.Type	As VirtualChannel1.Main.Type	uint8	1c80	7296	Not applicable
VirtualChannel.2.Main.Units	Units descriptor	string_t	4b30	19248	Not applicable
VirtualChannel.2.Main.UnitsScaler	Units scaler for totalisers	float32	1c83	7299	1dp
VirtualChannel.2.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1ca0	7328	Not applicable
VirtualChannel.2.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1ca2	7330	Same as VirtualChannel.2.Main.PV
VirtualChannel.2.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1ca1	7329	Same as VirtualChannel.2.Main.PV
VirtualChannel.3.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c4	452	Not applicable
VirtualChannel.3.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1d50	7504	Not applicable
VirtualChannel.3.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1d4b	7499	Not applicable
VirtualChannel.3.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1d48	7496	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1d4a	7498	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1d42	7490	Not applicable
VirtualChannel.3.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1d49	7497	Not applicable
VirtualChannel.3.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1d47	7495	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Dwell	Alarm dwell time	time_t	1d45	7493	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm1.Hysteresis	Alarm hysteresis value	float32	1d44	7492	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1d4e	7502	Not applicable
VirtualChannel.3.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1d41	7489	Not applicable
VirtualChannel.3.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1d4f	7503	Not applicable
VirtualChannel.3.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1d46	7494	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	012a	298	Not applicable
VirtualChannel.3.Alarm1.Threshold	Alarm trigger threshold	float32	1d43	7491	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1d40	7488	Not applicable
VirtualChannel.3.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c5	453	Not applicable
VirtualChannel.3.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1d70	7536	Not applicable
VirtualChannel.3.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1d6b	7531	Not applicable
VirtualChannel.3.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1d68	7528	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1d6a	7530	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1d62	7522	Not applicable
VirtualChannel.3.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1d69	7529	Not applicable
VirtualChannel.3.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1d67	7527	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Dwell	Alarm dwell time	time_t	1d65	7525	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Alarm2.Hysteresis	Alarm hysteresis value	float32	1d64	7524	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1d6e	7534	Not applicable
VirtualChannel.3.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1d61	7521	Not applicable
VirtualChannel.3.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1d6f	7535	Not applicable
VirtualChannel.3.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1d66	7526	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	012b	299	Not applicable
VirtualChannel.3.Alarm2.Threshold	Alarm trigger threshold	float32	1d63	7523	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1d60	7520	Not applicable
VirtualChannel.3.Main.Descriptor	Virtual Channel descriptor	string_t	4b36	19254	Not applicable
VirtualChannel.3.Main.Disable	1 = Virtual channel disabled	bool	1d23	7459	Not applicable
VirtualChannel.3.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1d05	7429	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Input1	Input 1	float32	1d07	7431	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Input2	Input 2	float32	1d08	7432	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1d04	7428	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.ModbusInput	Modbus input value	float32	1d06	7430	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1d01	7425	Not applicable
VirtualChannel.3.Main.Period	The time period over which the calculation is made	int32	1d0a	7434	Not applicable
VirtualChannel.3.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1d0c	7436	Not applicable
VirtualChannel.3.Main.PresetValue	The Preset value	float32	1d0d	7437	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.PV	The virtual channel output value	float32	0128	296	Set by VirtualChannel.3.Main.Resolution
VirtualChannel.3.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1d0b	7435	Not applicable
VirtualChannel.3.Main.Resolution	Number of decimal places (0 to 6)	uint8	1d02	7426	Not applicable
VirtualChannel.3.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1d11	7441	Not applicable
VirtualChannel.3.Main.Status	As VirtualChannel1.Main.Status	uint8	0129	297	Not applicable
VirtualChannel.3.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1d09	7433	Set by Network.Modbus.TimeFormat
VirtualChannel.3.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1d0e	7438	Not applicable
VirtualChannel.3.Main.Type	As VirtualChannel1.Main.Type	uint8	1d00	7424	Not applicable
VirtualChannel.3.Main.Units	Units descriptor	string_t	4b4b	19275	Not applicable
VirtualChannel.3.Main.UnitsScaler	Units scaler for totalisers	float32	1d03	7427	1dp
VirtualChannel.3.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1d20	7456	Not applicable
VirtualChannel.3.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1d22	7458	Same as VirtualChannel.3.Main.PV
VirtualChannel.3.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1d21	7457	Same as VirtualChannel.3.Main.PV
VirtualChannel.4.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c6	454	Not applicable
VirtualChannel.4.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1dd0	7632	Not applicable
VirtualChannel.4.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1dcb	7627	Not applicable
VirtualChannel.4.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1dc8	7624	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1dca	7626	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1dc2	7618	Not applicable
VirtualChannel.4.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1dc9	7625	Not applicable
VirtualChannel.4.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1dc7	7623	Same as VirtualChannel.4.Main.PV

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.4.Alarm1.Dwell	Alarm dwell time	time_t	1dc5	7621	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm1.Hysteresis	Alarm hysteresis value	float32	1dc4	7620	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1dce	7630	Not applicable
VirtualChannel.4.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1dc1	7617	Not applicable
VirtualChannel.4.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1dcf	7631	Not applicable
VirtualChannel.4.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1dc6	7622	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	012e	302	Not applicable
VirtualChannel.4.Alarm1.Threshold	Alarm trigger threshold	float32	1dc3	7619	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1dc0	7616	Not applicable
VirtualChannel.4.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c7	455	Not applicable
VirtualChannel.4.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1df0	7664	Not applicable
VirtualChannel.4.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1deb	7659	Not applicable
VirtualChannel.4.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1de8	7656	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1dea	7658	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1de2	7650	Not applicable
VirtualChannel.4.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1de9	7657	Not applicable
VirtualChannel.4.Alarm2.Deviation	Deviation alarAlarm dwell timeAlarm dwell	time_t	1de5	7653	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Alarm2.Hysteresis	Alarm hysteresis value	float32	1de4	7652	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1dee	7662	Not applicable
VirtualChannel.4.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1de1	7649	Not applicable
VirtualChannel.4.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1def	7663	Not applicable
VirtualChannel.4.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1de6	7654	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	012f	303	Not applicable
VirtualChannel.4.Alarm2.Threshold	Alarm trigger threshold	float32	1de3	7651	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1de0	7648	Not applicable
VirtualChannel.4.Main.Descriptor	Virtual Channel descriptor	string_t	4b51	19281	Not applicable
VirtualChannel.4.Main.Disable	1 = Virtual channel disabled	bool	1da3	7587	Not applicable
VirtualChannel.4.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1d85	7557	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Input1	Input 1 value	float32	1d87	7559	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Input2	Input 2 value	float32	1d88	7560	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1d84	7556	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.ModbusInput	Modbus input value	float32	1d86	7558	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1d81	7553	Not applicable
VirtualChannel.4.Main.Period	Averaging period	int32	1d8a	7562	Not applicable
VirtualChannel.4.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1d8c	7564	Not applicable
VirtualChannel.4.Main.PresetValue	The Preset value	float32	1d8d	7565	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.PV	The virtual channel output value	float32	012c	300	Set by VirtualChannel.4.Main.Resolution
VirtualChannel.4.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1d8b	7563	Not applicable
VirtualChannel.4.Main.Resolution	Number of decimal places (0 to 6)	uint8	1d82	7554	Not applicable
VirtualChannel.4.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1d91	7569	Not applicable
VirtualChannel.4.Main.Status	As VirtualChannel1.Main.Status	uint8	012d	301	Not applicable
VirtualChannel.4.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1d89	7561	Set by Network.Modbus.TimeFormat
VirtualChannel.4.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1d8e	7566	Not applicable
VirtualChannel.4.Main.Type	As VirtualChannel1.Main.Type	uint8	1d80	7552	Not applicable
VirtualChannel.4.Main.Units	Units descriptor	string_t	4b66	19302	Not applicable
VirtualChannel.4.Main.UnitsScaler	Units scaler for totalisers	float32	1d83	7555	1dp
VirtualChannel.4.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1da0	7584	Not applicable
VirtualChannel.4.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1da2	7586	Same as VirtualChannel.4.Main.PV
VirtualChannel.4.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1da1	7585	Same as VirtualChannel.4.Main.PV
VirtualChannel.5.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01c8	456	Not applicable
VirtualChannel.5.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1e50	7760	Not applicable
VirtualChannel.5.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1e4b	7755	Not applicable
VirtualChannel.5.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1e48	7752	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1e4a	7754	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1e42	7746	Not applicable
VirtualChannel.5.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1e49	7753	Not applicable
VirtualChannel.5.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1e47	7751	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Dwell	Alarm dwell time	time_t	1e45	7749	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm1.Hysteresis	Alarm hysteresis value	float32	1e44	7748	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1e4e	7758	Not applicable
VirtualChannel.5.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1e41	7745	Not applicable
VirtualChannel.5.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1e4f	7759	Not applicable
VirtualChannel.5.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1e46	7750	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0132	306	Not applicable
VirtualChannel.5.Alarm1.Threshold	Alarm trigger threshold	float32	1e43	7747	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1e40	7744	Not applicable
VirtualChannel.5.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01c9	457	Not applicable
VirtualChannel.5.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1e70	7792	Not applicable
VirtualChannel.5.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1e6b	7787	Not applicable
VirtualChannel.5.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1e68	7784	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1e6a	7786	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1e62	7778	Not applicable
VirtualChannel.5.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1e69	7785	Not applicable
VirtualChannel.5.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1e67	7783	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Dwell	Alarm dwell time	time_t	1e65	7781	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Alarm2.Hysteresis	Alarm hysteresis value	float32	1e64	7780	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1e6e	7790	Not applicable
VirtualChannel.5.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1e61	7777	Not applicable
VirtualChannel.5.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1e6f	7791	Not applicable
VirtualChannel.5.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1e66	7782	Same as VirtualChannel.5.Main.PV

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.5.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0133	307	Not applicable
VirtualChannel.5.Alarm2.Threshold	Alarm trigger threshold	float32	1e63	7779	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1e60	7776	Not applicable
VirtualChannel.5.Main.Descriptor	Virtual Channel descriptor	string_t	4b6c	19308	Not applicable
VirtualChannel.5.Main.Disable	1 = Virtual channel disabled	bool	1e23	7715	Not applicable
VirtualChannel.5.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1e05	7685	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Input1	Input 1 value	float32	1e07	7687	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Input2	Input 2 value	float32	1e08	7688	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1e04	7684	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.ModbusInput	Modbus input value	float32	1e06	7686	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1e01	7681	Not applicable
VirtualChannel.5.Main.Period	The time period over which the calculation is made	int32	1e0a	7690	Not applicable
VirtualChannel.5.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1e0c	7692	Not applicable
VirtualChannel.5.Main.PresetValue	The Preset value	float32	1e0d	7693	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.PV	The virtual channel output value	float32	0130	304	Set by VirtualChannel.5.Main.Resolution
VirtualChannel.5.Main.Reset	nitiate reset. 0 = No; 1 = Yes	bool	1e0b	7691	Not applicable
VirtualChannel.5.Main.Resolution	Number of decimal places (0 to 6)	uint8	1e02	7682	Not applicable
VirtualChannel.5.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1e11	7697	Not applicable
VirtualChannel.5.Main.Status	As VirtualChannel1.Main.Status	uint8	0131	305	Not applicable
VirtualChannel.5.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1e09	7689	Set by Network.Modbus.TimeFormat
VirtualChannel.5.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1e0e	7694	Not applicable
VirtualChannel.5.Main.Type	As VirtualChannel1.Main.Type	uint8	1e00	7680	Not applicable
VirtualChannel.5.Main.Units	Units descriptor	string_t	4b81	19329	Not applicable
VirtualChannel.5.Main.UnitsScaler	Units scaler for totalisers	float32	1e03	7683	1dp
VirtualChannel.5.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1e20	7712	Not applicable
VirtualChannel.5.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1e22	7714	Same as VirtualChannel.5.Main.PV
VirtualChannel.5.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1e21	7713	Same as VirtualChannel.5.Main.PV
VirtualChannel.6.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01ca	458	Not applicable
VirtualChannel.6.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1ed0	7888	Not applicable
VirtualChannel.6.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1ecb	7883	Not applicable
VirtualChannel.6.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1ec8	7880	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1eca	7882	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ec2	7874	Not applicable
VirtualChannel.6.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ec9	7881	Not applicable
VirtualChannel.6.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1ec7	7879	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Dwell	Alarm dwell time	time_t	1ec5	7877	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm1.Hysteresis	Alarm hysteresis value	float32	1ec4	7876	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1ece	7886	Not applicable
VirtualChannel.6.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ec1	7873	Not applicable
VirtualChannel.6.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1ecf	7887	Not applicable
VirtualChannel.6.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1ec6	7878	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0136	310	Not applicable
VirtualChannel.6.Alarm1.Threshold	Alarm trigger threshold	float32	1ec3	7875	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1ec0	7872	Not applicable
VirtualChannel.6.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cb	459	Not applicable
VirtualChannel.6.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1ef0	7920	Not applicable
VirtualChannel.6.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1eeb	7915	Not applicable
VirtualChannel.6.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1ee8	7912	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1eea	7914	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1ee2	7906	Not applicable
VirtualChannel.6.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1ee9	7913	Not applicable
VirtualChannel.6.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1ee7	7911	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Dwell	Alarm dwell time	time_t	1ee5	7909	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Alarm2.Hysteresis	Alarm hysteresis value	float32	1ee4	7908	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1eee	7918	Not applicable
VirtualChannel.6.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1ee1	7905	Not applicable
VirtualChannel.6.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1eef	7919	Not applicable
VirtualChannel.6.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1ee6	7910	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0137	311	Not applicable
VirtualChannel.6.Alarm2.Threshold	Alarm trigger threshold	float32	1ee3	7907	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1ee0	7904	Not applicable
VirtualChannel.6.Main.Descriptor	Virtual Channel descriptor	string_t	4b87	19335	Not applicable
VirtualChannel.6.Main.Disable	1 = Virtual channel disabled	bool	1ea3	7843	Not applicable
VirtualChannel.6.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1e85	7813	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Input1	Input 1 value	float32	1e87	7815	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Input2	Input 2 value	float32	1e88	7816	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1e84	7812	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.ModbusInput	Modbus input value	float32	1e86	7814	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1e81	7809	Not applicable
VirtualChannel.6.Main.Period	The time period over which the calculation is made	int32	1e8a	7818	Not applicable
VirtualChannel.6.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1e8c	7820	Not applicable
VirtualChannel.6.Main.PresetValue	The Preset value	float32	1e8d	7821	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.PV	The virtual channel output value	float32	0134	308	Set by VirtualChannel.6.Main.Resolution
VirtualChannel.6.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1e8b	7819	Not applicable
VirtualChannel.6.Main.Resolution	Number of decimal places (0 to 6)	uint8	1e82	7810	Not applicable
VirtualChannel.6.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1e91	7825	Not applicable
VirtualChannel.6.Main.Status	As VirtualChannel1.Main.Status	uint8	0135	309	Not applicable
VirtualChannel.6.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1e89	7817	Set by Network.Modbus.TimeFormat
VirtualChannel.6.Main.Trigger	ncrement/decrement counter. 0 = No; 1 = Yes	bool	1e8e	7822	Not applicable
VirtualChannel.6.Main.Type	As VirtualChannel1.Main.Type	uint8	1e80	7808	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.6.Main.Units	Units descriptor	string_t	4b9c	19356	Not applicable
VirtualChannel.6.Main.UnitsScaler	Units scaler for totalisers	float32	1e83	7811	1dp
VirtualChannel.6.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1ea0	7840	Not applicable
VirtualChannel.6.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1ea2	7842	Same as VirtualChannel.6.Main.PV
VirtualChannel.6.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1ea1	7841	Same as VirtualChannel.6.Main.PV
VirtualChannel.7.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01cc	460	Not applicable
VirtualChannel.7.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1f50	8016	Not applicable
VirtualChannel.7.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1f4b	8011	Not applicable
VirtualChannel.7.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1f48	8008	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1f4a	8010	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1f42	8002	Not applicable
VirtualChannel.7.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1f49	8009	Not applicable
VirtualChannel.7.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1f47	8007	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Dwell	Alarm dwell time	time_t	1f45	8005	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm1.Hysteresis	Alarm hysteresis value	float32	1f44	8004	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1f4e	8014	Not applicable
VirtualChannel.7.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1f41	8001	Not applicable
VirtualChannel.7.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1f4f	8015	Not applicable
VirtualChannel.7.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1f46	8006	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	013a	314	Not applicable
VirtualChannel.7.Alarm1.Threshold	Alarm trigger threshold	float32	1f43	8003	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1f40	8000	Not applicable
VirtualChannel.7.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cd	461	Not applicable
VirtualChannel.7.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1f70	8048	Not applicable
VirtualChannel.7.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1f6b	8043	Not applicable
VirtualChannel.7.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1f68	8040	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1f6a	8042	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1f62	8034	Not applicable
VirtualChannel.7.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1f69	8041	Not applicable
VirtualChannel.7.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1f67	8039	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Dwell	Alarm dwell time	time_t	1f65	8037	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Alarm2.Hysteresis	Alarm hysteresis value	float32	1f64	8036	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1f6e	8046	Not applicable
VirtualChannel.7.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1f61	8033	Not applicable
VirtualChannel.7.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1f6f	8047	Not applicable
VirtualChannel.7.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1f66	8038	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Status	As VirtualChanneAlarm trigger thresholdAlarm threshold	float32	1f63	8035	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1f60	8032	Not applicable
VirtualChannel.7.Main.Descriptor	Virtual Channel descriptor	string_t	4ba2	19362	Not applicable
VirtualChannel.7.Main.Disable	1 = Virtual channel disabled	bool	1f23	7971	Not applicable
VirtualChannel.7.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1f05	7941	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Input1	Input 1 value	float32	1f07	7943	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Input2	Input 2 value	float32	1f08	7944	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1f04	7940	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.ModbusInput	Modbus input value	float32	1f06	7942	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1f01	7937	Not applicable
VirtualChannel.7.Main.Period	Averaging period	int32	1f0a	7946	Not applicable
VirtualChannel.7.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1f0c	7948	Not applicable
VirtualChannel.7.Main.PresetValue	The Preset value	float32	1f0d	7949	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.PV	The virtual channel output value	float32	0138	312	Set by VirtualChannel.7.Main.Resolution
VirtualChannel.7.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1f0b	7947	Not applicable
VirtualChannel.7.Main.Resolution	Number of decimal places (0 to 6)	uint8	1f02	7938	Not applicable
VirtualChannel.7.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1f11	7953	Not applicable
VirtualChannel.7.Main.Status	As VirtualChannel1.Main.Status	uint8	0139	313	Not applicable
VirtualChannel.7.Main.TimeRemaining	Time remaining before calculation is made	time_t	1f09	7945	Set by Network.Modbus.TimeFormat
VirtualChannel.7.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1f0e	7950	Not applicable
VirtualChannel.7.Main.Type	As VirtualChannel1.Main.Type	uint8	1f00	7936	Not applicable
VirtualChannel.7.Main.Units	Units descriptor	string_t	4bb7	19383	Not applicable
VirtualChannel.7.Main.UnitsScaler	Units scaler for totalisers	float32	1f03	7939	1dp
VirtualChannel.7.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1f20	7968	Not applicable
VirtualChannel.7.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1f22	7970	Same as VirtualChannel.7.Main.PV
VirtualChannel.7.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1f21	7969	Same as VirtualChannel.7.Main.PV
VirtualChannel.8.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01ce	462	Not applicable
VirtualChannel.8.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	1fd0	8144	Not applicable
VirtualChannel.8.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	1fcb	8139	Not applicable
VirtualChannel.8.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	1fc8	8136	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	1fca	8138	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1fc2	8130	Not applicable
VirtualChannel.8.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1fc9	8137	Not applicable
VirtualChannel.8.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	1fc7	8135	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Dwell	Alarm dwell time	time_t	1fc5	8133	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm1.Hysteresis	Alarm hysteresis value	float32	1fc4	8132	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1fce	8142	Not applicable
VirtualChannel.8.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1fc1	8129	Not applicable
VirtualChannel.8.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	1fcf	8143	Not applicable
VirtualChannel.8.Alarm1.Reference	Deviation alarm 'Reference' value	float32	1fc6	8134	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	013e	318	Not applicable
VirtualChannel.8.Alarm1.Threshold	Alarm trigger threshold	float32	1fc3	8131	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	1fc0	8128	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.8.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01cf	463	Not applicable
VirtualChannel.8.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	1ff0	8176	Not applicable
VirtualChannel.8.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	1feb	8171	Not applicable
VirtualChannel.8.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	1fe8	8168	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	1fea	8170	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	1fe2	8162	Not applicable
VirtualChannel.8.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	1fe9	8169	Not applicable
VirtualChannel.8.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	1fe7	8167	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Dwell	Alarm dwell time	time_t	1fe5	8165	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Alarm2.Hysteresis	Alarm hysteresis value	float32	1fe4	8164	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	1fee	8174	Not applicable
VirtualChannel.8.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	1fe1	8161	Not applicable
VirtualChannel.8.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	1fef	8175	Not applicable
VirtualChannel.8.Alarm2.Reference	Deviation alarm 'Reference' value	float32	1fe6	8166	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	013f	319	Not applicable
VirtualChannel.8.Alarm2.Threshold	Alarm trigger threshold	float32	1fe3	8163	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	1fe0	8160	Not applicable
VirtualChannel.8.Main.Descriptor	Virtual Channel descriptor	string_t	4bbd	19389	Not applicable
VirtualChannel.8.Main.Disable	1 = Virtual channel disabled	bool	1fa3	8099	Not applicable
VirtualChannel.8.Main.HighCutOff	The highest input value that will be totalised/counted	float32	1f85	8069	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Input1	Input 1 value	float32	1f87	8071	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Input2	Input 2 value	float32	1f88	8072	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	1f84	8068	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.ModbusInput	Modbus input value	float32	1f86	8070	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Operation	As VirtualChannel1.Main.Operation	uint8	1f81	8065	Not applicable
VirtualChannel.8.Main.Period	The time period over which the calculation is made	int32	1f8a	8074	Not applicable
VirtualChannel.8.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	1f8c	8076	Not applicable
VirtualChannel.8.Main.PresetValue	The Preset value	float32	1f8d	8077	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.PV	The virtual channel output value	float32	013c	316	Set by VirtualChannel.8.Main.Resolution
VirtualChannel.8.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	1f8b	8075	Not applicable
VirtualChannel.8.Main.Resolution	Number of decimal places (0 to 6)	uint8	1f82	8066	Not applicable
VirtualChannel.8.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	1f91	8081	Not applicable
VirtualChannel.8.Main.Status	As VirtualChannel1.Main.Status	uint8	013d	317	Not applicable
VirtualChannel.8.Main.TimeRemaining	Time remaining before the calculation is made	time_t	1f89	8073	Set by Network.Modbus.TimeFormat
VirtualChannel.8.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	1f8e	8078	Not applicable
VirtualChannel.8.Main.Type	As VirtualChannel1.Main.Type	uint8	1f80	8064	Not applicable
VirtualChannel.8.Main.Units	Units descriptor	string_t	4bd2	19410	Not applicable
VirtualChannel.8.Main.UnitsScaler	Units scaler for totalisers	float32	1f83	8067	1dp
VirtualChannel.8.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	1fa0	8096	Not applicable
VirtualChannel.8.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	1fa2	8098	Same as VirtualChannel.8.Main.PV
VirtualChannel.8.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	1fa1	8097	Same as VirtualChannel.8.Main.PV
VirtualChannel.9.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d0	464	Not applicable
VirtualChannel.9.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2050	8272	Not applicable
VirtualChannel.9.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	204b	8267	Not applicable
VirtualChannel.9.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2048	8264	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	204a	8266	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2042	8258	Not applicable
VirtualChannel.9.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2049	8265	Not applicable
VirtualChannel.9.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2047	8263	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Dwell	Alarm dwell time	time_t	2045	8261	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm1.Hysteresis	Alarm hysteresis value	float32	2044	8260	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	204e	8270	Not applicable
VirtualChannel.9.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2041	8257	Not applicable
VirtualChannel.9.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	204f	8271	Not applicable
VirtualChannel.9.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2046	8262	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0142	322	Not applicable
VirtualChannel.9.Alarm1.Threshold	Alarm trigger threshold	float32	2043	8259	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2040	8256	Not applicable
VirtualChannel.9.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d1	465	Not applicable
VirtualChannel.9.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2070	8304	Not applicable
VirtualChannel.9.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	206b	8299	Not applicable
VirtualChannel.9.Alarm2.Amount	Rate-of-change alarm 'Amount't	float32	2068	8296	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	206a	8298	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2062	8290	Not applicable
VirtualChannel.9.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2069	8297	Not applicable
VirtualChannel.9.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2067	8295	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Dwell	Alarm dwell time	time_t	2065	8293	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Alarm2.Hysteresis	Alarm hysteresis value	float32	2064	8292	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	206e	8302	Not applicable
VirtualChannel.9.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2061	8289	Not applicable
VirtualChannel.9.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	206f	8303	Not applicable
VirtualChannel.9.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2066	8294	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0143	323	Not applicable
VirtualChannel.9.Alarm2.Threshold	Alarm trigger threshold	float32	2063	8291	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2060	8288	Not applicable
VirtualChannel.9.Main.Descriptor	Virtual Channel descriptor	string_t	4bd8	19416	Not applicable
VirtualChannel.9.Main.Disable	1 = Virtual channel disabled	bool	2023	8227	Not applicable
VirtualChannel.9.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2005	8197	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Input1	Input 1 value	float32	2007	8199	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Input2	Input 2 value	float32	2008	8200	Set by VirtualChannel.9.Main.Resolution

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.9.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2004	8196	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.ModbusInput	Modbus input value	float32	2006	8198	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2001	8193	Not applicable
VirtualChannel.9.Main.Period	The time period over which the calculation is made	int32	200a	8202	Not applicable
VirtualChannel.9.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	200c	8204	Not applicable
VirtualChannel.9.Main.PresetValue	The Preset value	float32	200d	8205	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.PV	The virtual channel output value	float32	0140	320	Set by VirtualChannel.9.Main.Resolution
VirtualChannel.9.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	200b	8203	Not applicable
VirtualChannel.9.Main.Resolution	Number of decimal places (0 to 6)	uint8	2002	8194	Not applicable
VirtualChannel.9.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2011	8209	Not applicable
VirtualChannel.9.Main.Status	As VirtualChannel1.Main.Status	uint8	0141	321	Not applicable
VirtualChannel.9.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2009	8201	Set by Network.Modbus.TimeFormat
VirtualChannel.9.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	200e	8206	Not applicable
VirtualChannel.9.Main.Type	As VirtualChannel1.Main.Type	uint8	2000	8192	Not applicable
VirtualChannel.9.Main.Units	Units descriptor	string_t	4bed	19437	Not applicable
VirtualChannel.9.Main.UnitsScaler	Units scaler for totalisers	float32	2003	8195	1dp
VirtualChannel.9.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2020	8224	Not applicable
VirtualChannel.9.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2022	8226	Same as VirtualChannel.9.Main.PV
VirtualChannel.9.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2021	8225	Same as VirtualChannel.9.Main.PV
VirtualChannel.10.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d2	466	Not applicable
VirtualChannel.10.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	20d0	8400	Not applicable
VirtualChannel.10.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	20cb	8395	Not applicable
VirtualChannel.10.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	20c8	8392	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	20ca	8394	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	20c2	8386	Not applicable
VirtualChannel.10.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	20c9	8393	Not applicable
VirtualChannel.10.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	20c7	8391	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Dwell	Alarm dwell time	time_t	20c5	8389	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm1.Hysteresis	Alarm hysteresis value	float32	20c4	8388	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	20ce	8398	Not applicable
VirtualChannel.10.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	20c1	8385	Not applicable
VirtualChannel.10.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	20cf	8399	Not applicable
VirtualChannel.10.Alarm1.Reference	Deviation alarm 'Reference' value	float32	20c6	8390	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0146	326	Not applicable
VirtualChannel.10.Alarm1.Threshold	Alarm trigger threshold	float32	20c3	8387	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	20c0	8384	Not applicable
VirtualChannel.10.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d3	467	Not applicable
VirtualChannel.10.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	20f0	8432	Not applicable
VirtualChannel.10.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	20eb	8427	Not applicable
VirtualChannel.10.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	20e8	8424	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	20ea	8426	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	20e2	8418	Not applicable
VirtualChannel.10.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	20e9	8425	Not applicable
VirtualChannel.10.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	20e7	8423	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Dwell	Alarm dwell time	time_t	20e5	8421	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Alarm2.Hysteresis	Alarm hysteresis value	float32	20e4	8420	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	20ee	8430	Not applicable
VirtualChannel.10.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	20e1	8417	Not applicable
VirtualChannel.10.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	20ef	8431	Not applicable
VirtualChannel.10.Alarm2.Reference	Deviation alarm 'Reference' value	float32	20e6	8422	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0147	327	Not applicable
VirtualChannel.10.Alarm2.Threshold	Alarm trigger threshold	float32	20e3	8419	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	20e0	8416	Not applicable
VirtualChannel.10.Main.Descriptor	Virtual Channel descriptor	string_t	4bf3	19443	Not applicable
VirtualChannel.10.Main.Disable	1 = Virtual channel disabled	bool	20a3	8355	Not applicable
VirtualChannel.10.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2085	8325	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Input1	Input 1 value	float32	2087	8327	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Input2	Input 2 value	float32	2088	8328	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2084	8324	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.ModbusInput	Modbus input value	float32	2086	8326	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2081	8321	Not applicable
VirtualChannel.10.Main.Period	Averaging period	int32	208a	8330	Not applicable
VirtualChannel.10.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	208c	8332	Not applicable
VirtualChannel.10.Main.PresetValue	The Preset value	float32	208d	8333	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.PV	The virtual channel output value	float32	0144	324	Set by VirtualChannel.10.Main.Resolution
VirtualChannel.10.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	208b	8331	Not applicable
VirtualChannel.10.Main.Resolution	Number of decimal places (0 to 6)	uint8	2082	8322	Not applicable
VirtualChannel.10.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2091	8337	Not applicable
VirtualChannel.10.Main.Status	As VirtualChannel1.Main.Status	uint8	0145	325	Not applicable
VirtualChannel.10.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2089	8329	Set by Network.Modbus.TimeFormat
VirtualChannel.10.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	208e	8334	Not applicable
VirtualChannel.10.Main.Type	As VirtualChannel1.Main.Type	uint8	2080	8320	Not applicable
VirtualChannel.10.Main.Units	Units descriptor	string_t	4c08	19464	Not applicable
VirtualChannel.10.Main.UnitsScaler	Units scaler for totalisers	float32	2083	8323	1dp
VirtualChannel.10.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	20a0	8352	Not applicable
VirtualChannel.10.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	20a2	8354	Same as VirtualChannel.10.Main.PV
VirtualChannel.10.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	20a1	8353	Same as VirtualChannel.10.Main.PV
VirtualChannel.11.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d4	468	Not applicable
VirtualChannel.11.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2150	8528	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.11.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	214b	8523	Not applicable
VirtualChannel.11.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2148	8520	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	214a	8522	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2142	8514	Not applicable
VirtualChannel.11.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2149	8521	Not applicable
VirtualChannel.11.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2147	8519	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Dwell	Alarm dwell time	time_t	2145	8517	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm1.Hysteresis	Alarm hysteresis value	float32	2144	8516	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	214e	8526	Not applicable
VirtualChannel.11.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2141	8513	Not applicable
VirtualChannel.11.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	214f	8527	Not applicable
VirtualChannel.11.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2146	8518	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	014a	330	Not applicable
VirtualChannel.11.Alarm1.Threshold	Alarm trigger threshold	float32	2143	8515	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2140	8512	Not applicable
VirtualChannel.11.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d5	469	Not applicable
VirtualChannel.11.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2170	8560	Not applicable
VirtualChannel.11.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	216b	8555	Not applicable
VirtualChannel.11.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	2168	8552	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	216a	8554	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2162	8546	Not applicable
VirtualChannel.11.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2169	8553	Not applicable
VirtualChannel.11.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2167	8551	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Dwell	Alarm dwell time	time_t	2165	8549	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Alarm2.Hysteresis	Alarm hysteresis value	float32	2164	8548	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	216e	8558	Not applicable
VirtualChannel.11.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2161	8545	Not applicable
VirtualChannel.11.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	216f	8559	Not applicable
VirtualChannel.11.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2166	8550	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	014b	331	Not applicable
VirtualChannel.11.Alarm2.Threshold	Alarm trigger threshold	float32	2163	8547	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2160	8544	Not applicable
VirtualChannel.11.Main.Descriptor	Virtual Channel descriptor	string_t	4c0e	19470	Not applicable
VirtualChannel.11.Main.Disable	1 = Virtual channel disabled	bool	2123	8483	Not applicable
VirtualChannel.11.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2105	8453	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Input1	Input 1 value	float32	2107	8455	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Input2	Input 2 value	float32	2108	8456	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2104	8452	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.ModbusInput	Modbus input value	float32	2106	8454	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2101	8449	Not applicable
VirtualChannel.11.Main.Period	The time period over which the calculation is made	int32	210a	8458	Not applicable
VirtualChannel.11.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	210c	8460	Not applicable
VirtualChannel.11.Main.PresetValue	The Preset value	float32	210d	8461	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.PV	The virtual channel output value	float32	0148	328	Set by VirtualChannel.11.Main.Resolution
VirtualChannel.11.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	210b	8459	Not applicable
VirtualChannel.11.Main.Resolution	Number of decimal places (0 to 6)	uint8	2102	8450	Not applicable
VirtualChannel.11.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2111	8465	Not applicable
VirtualChannel.11.Main.Status	As VirtualChannel1.Main.Status	uint8	0149	329	Not applicable
VirtualChannel.11.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2109	8457	Set by Network.Modbus.TimeFormat
VirtualChannel.11.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	210e	8462	Not applicable
VirtualChannel.11.Main.Type	As VirtualChannel1.Main.Type	uint8	2100	8448	Not applicable
VirtualChannel.11.Main.Units	Units descriptor	string_t	4c23	19491	Not applicable
VirtualChannel.11.Main.UnitsScaler	Units scaler for totalisers	float32	2103	8451	1dp
VirtualChannel.11.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2120	8480	Not applicable
VirtualChannel.11.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2122	8482	Same as VirtualChannel.11.Main.PV
VirtualChannel.11.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2121	8481	Same as VirtualChannel.11.Main.PV
VirtualChannel.12.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d6	470	Not applicable
VirtualChannel.12.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	21d0	8656	Not applicable
VirtualChannel.12.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	21cb	8651	Not applicable
VirtualChannel.12.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	21c8	8648	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	21ca	8650	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	21c2	8642	Not applicable
VirtualChannel.12.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	21c9	8649	Not applicable
VirtualChannel.12.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	21c7	8647	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Dwell	Alarm dwell time	time_t	21c5	8645	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm1.Hysteresis	Alarm hysteresis value	float32	21c4	8644	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	21ce	8654	Not applicable
VirtualChannel.12.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	21c1	8641	Not applicable
VirtualChannel.12.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	21cf	8655	Not applicable
VirtualChannel.12.Alarm1.Reference	Deviation alarm 'Reference' value	float32	21c6	8646	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	014e	334	Not applicable
VirtualChannel.12.Alarm1.Threshold	Alarm trigger threshold	float32	21c3	8643	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	21c0	8640	Not applicable
VirtualChannel.12.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d7	471	Not applicable
VirtualChannel.12.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	21f0	8688	Not applicable
VirtualChannel.12.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	21eb	8683	Not applicable
VirtualChannel.12.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	21e8	8680	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	21ea	8682	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	21e2	8674	Not applicable
VirtualChannel.12.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	21e9	8681	Not applicable

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.12.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	21e7	8679	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Dwell	Alarm dwell time	time_t	21e5	8677	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Alarm2.Hysteresis	Alarm hysteresis value	float32	21e4	8676	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	21ee	8686	Not applicable
VirtualChannel.12.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	21e1	8673	Not applicable
VirtualChannel.12.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	21ef	8687	Not applicable
VirtualChannel.12.Alarm2.Reference	Deviation alarm 'Reference' value	float32	21e6	8678	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	014f	335	Not applicable
VirtualChannel.12.Alarm2.Threshold	Alarm trigger threshold	float32	21e3	8675	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	21e0	8672	Not applicable
VirtualChannel.12.Main.Descriptor	Virtual Channel descriptorl	string_t	4c29	19497	Not applicable
VirtualChannel.12.Main.Disable	1 = Virtual channel disabled	bool	21a3	8611	Not applicable
VirtualChannel.12.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2185	8581	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Input1	Input 1 value	float32	2187	8583	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Input2	Input 2 value	float32	2188	8584	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2184	8580	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.ModbusInput	Modbus input value	float32	2186	8582	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2181	8577	Not applicable
VirtualChannel.12.Main.Period	The time period over which the calculation is made	int32	218a	8586	Not applicable
VirtualChannel.12.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	218c	8588	Not applicable
VirtualChannel.12.Main.PresetValue	The Preset value	float32	218d	8589	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.PV	The virtual channel output value	float32	014c	332	Set by VirtualChannel.12.Main.Resolution
VirtualChannel.12.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	218b	8587	Not applicable
VirtualChannel.12.Main.Resolution	Number of decimal places (0 to 6)	uint8	2182	8578	Not applicable
VirtualChannel.12.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2191	8593	Not applicable
VirtualChannel.12.Main.Status	As VirtualChannel1.Main.Status	uint8	014d	333	Not applicable
VirtualChannel.12.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2189	8585	Set by Network.Modbus.TimeFormat
VirtualChannel.12.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	218e	8590	Not applicable
VirtualChannel.12.Main.Type	As VirtualChannel1.Main.Type	uint8	2180	8576	Not applicable
VirtualChannel.12.Main.Units	Units descriptor	string_t	4c3e	19518	Not applicable
VirtualChannel.12.Main.UnitsScaler	Units scaler for totalisers	float32	2183	8579	1dp
VirtualChannel.12.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	21a0	8608	Not applicable
VirtualChannel.12.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	21a2	8610	Same as VirtualChannel.12.Main.PV
VirtualChannel.12.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	21a1	8609	Same as VirtualChannel.12.Main.PV
VirtualChannel.13.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01d8	472	Not applicable
VirtualChannel.13.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	2250	8784	Not applicable
VirtualChannel.13.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	224b	8779	Not applicable
VirtualChannel.13.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	2248	8776	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	224a	8778	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2242	8770	Not applicable
VirtualChannel.13.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2249	8777	Not applicable
VirtualChannel.13.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	2247	8775	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Dwell	Alarm dwell time	time_t	2245	8773	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm1.Hysteresis	Alarm hysteresis value	float32	2244	8772	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	224e	8782	Not applicable
VirtualChannel.13.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2241	8769	Not applicable
VirtualChannel.13.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	224f	8783	Not applicable
VirtualChannel.13.Alarm1.Reference	Deviation alarm 'Reference' value	float32	2246	8774	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0152	338	Not applicable
VirtualChannel.13.Alarm1.Threshold	Alarm trigger threshold	float32	2243	8771	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	2240	8768	Not applicable
VirtualChannel.13.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01d9	473	Not applicable
VirtualChannel.13.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	2270	8816	Not applicable
VirtualChannel.13.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	226b	8811	Not applicable
VirtualChannel.13.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	2268	8808	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	226a	8810	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	2262	8802	Not applicable
VirtualChannel.13.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	2269	8809	Not applicable
VirtualChannel.13.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	2267	8807	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Dwell	Alarm dwell time	time_t	2265	8805	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Alarm2.Hysteresis	Alarm hysteresis value	float32	2264	8804	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	226e	8814	Not applicable
VirtualChannel.13.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	2261	8801	Not applicable
VirtualChannel.13.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	226f	8815	Not applicable
VirtualChannel.13.Alarm2.Reference	Deviation alarm 'Reference' value	float32	2266	8806	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0153	339	Not applicable
VirtualChannel.13.Alarm2.Threshold	Alarm trigger threshold	float32	2263	8803	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	2260	8800	Not applicable
VirtualChannel.13.Main.Descriptor	Virtual Channel descriptor	string_t	4c44	19524	Not applicable
VirtualChannel.13.Main.Disable	1 = Virtual channel disabled	bool	2223	8739	Not applicable
VirtualChannel.13.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2205	8709	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Input1	Input 1 value	float32	2207	8711	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Input2	Input 2 value	float32	2208	8712	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2204	8708	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.ModbusInput	Modbus input value	float32	2206	8710	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2201	8705	Not applicable
VirtualChannel.13.Main.Period	The time period over which the calculation is made	int32	220a	8714	Not applicable
VirtualChannel.13.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	220c	8716	Not applicable
VirtualChannel.13.Main.PresetValue	The Preset value	float32	220d	8717	Set by VirtualChannel.13.Main.Resolution
VirtualChannel.13.Main.PV	The virtual channel output value	float32	0150	336	Set by VirtualChannel.13.Main.Resolution

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
VirtualChannel.13.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	220b	8715	Not applicable
VirtualChannel.13.Main.Resolution	Number of decimal places (0 to 6)	uint8	2202	8706	Not applicable
VirtualChannel.13.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2211	8721	Not applicable
VirtualChannel.13.Main.Status	As VirtualChannel1.Main.Status	uint8	0151	337	Not applicable
VirtualChannel.13.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2209	8713	Set by Network.Modbus.TimeFormat
VirtualChannel.13.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	220e	8718	Not applicable
VirtualChannel.13.Main.Type	As VirtualChannel1.Main.Type	uint8	2200	8704	Not applicable
VirtualChannel.13.Main.Units	Units descriptor	string_t	4c59	19545	Not applicable
VirtualChannel.13.Main.UnitsScaler	Units scaler for totalisers	float32	2203	8707	1dp
VirtualChannel.13.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	2220	8736	Not applicable
VirtualChannel.13.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	2222	8738	Same as VirtualChannel.13.Main.PV
VirtualChannel.13.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	2221	8737	Same as VirtualChannel.13.Main.PV
VirtualChannel.14.Alarm1.Acknowledge	1 = acknowledge alarm	bool	01da	474	Not applicable
VirtualChannel.14.Alarm1.Acknowledgement	1 = alarm acknowledged	bool	22d0	8912	Not applicable
VirtualChannel.14.Alarm1.Active	1 = alarm source active, or safe but not ack'd	bool	22cb	8907	Not applicable
VirtualChannel.14.Alarm1.Amount	Rate-of-change alarm 'Amount'	float32	22c8	8904	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.AverageTime	Rate-of-change alarm 'Average time'	time_t	22ca	8906	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm1.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	22c2	8898	Not applicable
VirtualChannel.14.Alarm1.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	22c9	8905	Not applicable
VirtualChannel.14.Alarm1.Deviation	Deviation alarm 'Deviation Value'	float32	22c7	8903	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Dwell	Alarm dwell time	time_t	22c5	8901	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm1.Hysteresis	Alarm hysteresis value	float32	22c4	8900	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	22ce	8910	Not applicable
VirtualChannel.14.Alarm1.Latch	As VirtualChannel1.Alarm1.Latch	uint8	22c1	8897	Not applicable
VirtualChannel.14.Alarm1.NotAcknowledged	1 = alarm has not been acknowledged	bool	22cf	8911	Not applicable
VirtualChannel.14.Alarm1.Reference	Deviation alarm 'Reference' value	float32	22c6	8902	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Status	As VirtualChannel1.Alarm1.Status	uint8	0156	342	Not applicable
VirtualChannel.14.Alarm1.Threshold	Alarm trigger threshold	float32	22c3	8899	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm1.Type	As VirtualChannel1.Alarm1.Type	uint8	22c0	8896	Not applicable
VirtualChannel.14.Alarm2.Acknowledge	1 = acknowledge alarm	bool	01db	475	Not applicable
VirtualChannel.14.Alarm2.Acknowledgement	1 = alarm acknowledged	bool	22f0	8944	Not applicable
VirtualChannel.14.Alarm2.Active	1 = alarm source active, or safe but not ack'd	bool	22eb	8939	Not applicable
VirtualChannel.14.Alarm2.Amount	Rate-of-change alarm 'Amount'	float32	22e8	8936	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.AverageTime	Rate-of-change alarm 'Average time'	time_t	22ea	8938	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm2.Block	0 = Blocking alarms off; 1 = Blocking alarms on	uint8	22e2	8930	Not applicable
VirtualChannel.14.Alarm2.ChangeTime	Rate-of-change alarm 'Change Time'	uint8	22e9	8937	Not applicable
VirtualChannel.14.Alarm2.Deviation	Deviation alarm 'Deviation Value'	float32	22e7	8935	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Dwell	Alarm dwell time	time_t	22e5	8933	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Alarm2.Hysteresis	Alarm hysteresis value	float32	22e4	8932	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Inactive	1 = alarm source safe and ack'd (if necessary)	bool	22ee	8942	Not applicable
VirtualChannel.14.Alarm2.Latch	As VirtualChannel1.Alarm1.Latch	uint8	22e1	8929	Not applicable
VirtualChannel.14.Alarm2.NotAcknowledged	1 = alarm has not been acknowledged	bool	22ef	8943	Not applicable
VirtualChannel.14.Alarm2.Reference	Deviation alarm 'Reference' value	float32	22e6	8934	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Status	As VirtualChannel1.Alarm1.Status	uint8	0157	343	Not applicable
VirtualChannel.14.Alarm2.Threshold	Alarm trigger threshold	float32	22e3	8931	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Alarm2.Type	As VirtualChannel1.Alarm1.Type	uint8	22e0	8928	Not applicable
VirtualChannel.14.Main.Descriptor	Virtual Channel descriptor	string_t	4c5f	19551	Not applicable
VirtualChannel.14.Main.Disable	1 = Virtual channel disabled	bool	22a3	8867	Not applicable
VirtualChannel.14.Main.HighCutOff	The highest input value that will be totalised/counted	float32	2285	8837	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Input1	Input 1 value	float32	2287	8839	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Input2	Input 2 value	float32	2288	8840	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.LowCutOff	The lowest input value that will be totalised/counted	float32	2284	8836	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.ModbusInput	Modbus input value	float32	2286	8838	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Operation	As VirtualChannel1.Main.Operation	uint8	2281	8833	Not applicable
VirtualChannel.14.Main.Period	The time period over which the calculation is made	int32	228a	8842	Not applicable
VirtualChannel.14.Main.Preset	Initiate preset. 0 = No; 1 = Yes	bool	228c	8844	Not applicable
VirtualChannel.14.Main.PresetValue	The preset value	float32	228d	8845	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.PV	The virtual channel output value	float32	0154	340	Set by VirtualChannel.14.Main.Resolution
VirtualChannel.14.Main.Reset	Initiate reset. 0 = No; 1 = Yes	bool	228b	8843	Not applicable
VirtualChannel.14.Main.Resolution	Number of decimal places (0 to 6)	uint8	2282	8834	Not applicable
VirtualChannel.14.Main.Rollover	A pulse signal to indicate PV (output) has just rolled over	bool	2291	8849	Not applicable
VirtualChannel.14.Main.Status	As VirtualChannel1.Main.Status	uint8	0155	341	Not applicable
VirtualChannel.14.Main.TimeRemaining	Time remaining before the calculation is made	time_t	2289	8841	Set by Network.Modbus.TimeFormat
VirtualChannel.14.Main.Trigger	Increment/decrement counter. 0 = No; 1 = Yes	bool	228e	8846	Not applicable
VirtualChannel.14.Main.Type	As VirtualChannel1.Main.Type	uint8	2280	8832	Not applicable
VirtualChannel.14.Main.Units	Units descriptor	string_t	4c75	19573	Not applicable
VirtualChannel.14.Main.UnitsScaler	Units scaler for totalisers	float32	2283	8835	1dp
VirtualChannel.14.Trend.Colour	As VirtualChannel1.Trend.Colour	uint8	22a0	8864	Not applicable
VirtualChannel.14.Trend.SpanHigh	Specifies the highest PV (output value) to be displayed	float32	22a2	8866	Same as VirtualChannel.14.Main.PV
VirtualChannel.14.Trend.SpanLow	Specifies the lowest PV (output value) to be displayed	float32	22a1	8865	Same as VirtualChannel.14.Main.PV
Zirconia.aC_CO_O2	Carbon Activity Between CO and O2	float32	289e	10398	4dp
Zirconia.BalanceIntegral	Balance Integral	bool	289d	10397	Not applicable
Zirconia.CarbonPot	Calculated Carbon Potential	float32	2892	10386	Set by Zirconia.Resolution
Zirconia.Clean.AbortClean	1 = Abort cleaning process	bool	28b5	10421	Not applicable
Zirconia.Clean.CantClean	1 = can't clean	bool	28c3	10435	Not applicable
Zirconia.Clean.CleanAbort	1 = Cleaning cycle has been aborted	bool	28c4	10436	Not applicable
Zirconia.Clean.CleanEnable	1 = probe cleaning allowed	bool	28b2	10418	Not applicable
Zirconia.Clean.CleanFreq	Interval between probe cleaning cycles	time_t	28aa	10410	Set by Network.Modbus.TimeFormat

5.3 PARAMETER LIST (Cont.)

Parameter path	Description	Type	Hex	Dec	Resolution
Zirconia.Clean.CleanMaxTemp	Maximum temperature for cleaning. If, during the cleaning cycle, the probe temperature exceeds this value, cleaning is aborted.	float32	28b4	10420	0dp
Zirconia.Clean.CleanMsgReset	1 = Clear cleaning related alarms	bool	28b3	10419	Not applicable
Zirconia.Clean.CleanProbe	1 = Initiate a probe cleaning cycle	bool	28b0	10416	Not applicable
Zirconia.Clean.CleanRecoveryTime	The time taken to recover from last clean. 0 = max. clean recovery time exceeded last time	time_t	28b6	10422	Set by Network.Modbus.TimeFormat
Zirconia.Clean.CleanTemp	1 = Clean cycle aborted because cleaning temperature was too high.	bool	28c5	10437	Not applicable
Zirconia.Clean.CleanTime	The time for which the probe is cleaned	time_t	28ab	10411	Set by Network.Modbus.TimeFormat
Zirconia.Clean.CleanValve	1 = Enable probe cleaning valve	bool	28af	10415	Not applicable
Zirconia.Clean.LastCleanMv	Probe output after last clean, in mV	float32	28b7	10423	0dp
Zirconia.Clean.MaxRcovTime	Max. recovery time after a purge	time_t	28ad	10413	Set by Network.Modbus.TimeFormat
Zirconia.Clean.MinRcovTime	Min. recovery time after a purge	time_t	28ac	10412	Set by Network.Modbus.TimeFormat
Zirconia.Clean.ProbeFault	1 = Probe failed to recover following the clean cycle	bool	28ae	10414	Not applicable
Zirconia.Clean.Time2Clean	Time to next cleaning cycle	time_t	28b1	10417	Set by Network.Modbus.TimeFormat
Zirconia.CleanFreq	Interval between cleaning cycles	time_t	2889	10377	Set by Network.Modbus.TimeFormat
Zirconia.CleanProbe	Initiates a demand cleaning cycle	bool	289a	10394	Not applicable
Zirconia.CleanState	Cleaning State (0 = Waiting, 1 = Cleaning, 2 = Recovering)	uint8	2899	10393	Not applicable
Zirconia.CleanTime	The time for which the probe is cleaned	time_t	288a	10378	Set by Network.Modbus.TimeFormat
Zirconia.CleanValve	1 = Enable probe cleaning valve	bool	2898	10392	Not applicable
Zirconia.DewPoint	Calculated Dewpoint	float32	2893	10387	Set by Zirconia.Resolution
Zirconia.GasRef	Reference value for hydrogen concentration	float32	2882	10370	1dp
Zirconia.GasRefs.CO_Ideal	Gas ref value when Oxygen Type = Nernst	float32	28a9	10409	1dp
Zirconia.GasRefs.CO_InUse	The CO gas measurement value being used	float32	28a4	10404	1dp
Zirconia.GasRefs.CO_Local	Reference value for CO concentration	float32	28a1	10401	1dp
Zirconia.GasRefs.CO_Remote	CO concentration from remote source	float32	28a2	10402	1dp
Zirconia.GasRefs.CO_RemoteEn	1 = Allow remote gas measurement	bool	28a3	10403	Not applicable
Zirconia.GasRefs.H2_InUse	The hydrogen gas measurement value being used	float32	28a8	10408	1dp
Zirconia.GasRefs.H2_Local	Reference value for hydrogen concentration	float32	28a5	10405	1dp
Zirconia.GasRefs.H2_Remote	Hydrogen concentration from remote source	float32	28a6	10406	1dp
Zirconia.GasRefs.H2_RemoteEn	1 = Allow remote gas measurement	bool	28a7	10407	Not applicable
Zirconia.MaxRcovTime	Maximum recovery time after a purge	time_t	288c	10380	Set by Network.Modbus.TimeFormat
Zirconia.MinCalTemp	Min. temp at which the calculation is valid	float32	2886	10374	Same as Zirconia.TempInput
Zirconia.MinRcovTime	Minimum recovery time after a purge	time_t	288b	10379	Set by Network.Modbus.TimeFormat
Zirconia.NumResolution	Number of decimal places	uint8	2881	10369	Not applicable
Zirconia.Oxygen	Calculated Oxygen value	float32	2894	10388	Set by Zirconia.Resolution
Zirconia.OxygenExp	Exponent used by log oxygen calculations	int16	288d	10381	Not applicable
Zirconia.OxygenType	The oxygen equation being used. 0 = Nernst 1=Nernst Bosch 2 = Nernst CP 3= Ferronova	uint8	28a0	10400	Not applicable
Zirconia.ProbeFault	Probe Clean Recovery Warning	bool	2896	10390	Not applicable
Zirconia.ProbeInput	Probe input in mV	float32	2890	10384	0dp
Zirconia.ProbeOffset	Probe offset in mV	float32	2891	10385	Set by Zirconia.Resolution
Zirconia.ProbeState	State of the probe measurement system 0 = Measuring 1 = Cleaning 2 = Clean Recovery 3 = Test impedance 4 = Impedance recovery 5 = Not ready	uint8	289f	10399	Not applicable
Zirconia.ProbeStatus	Status of Probe 0 = OK 1 = mVSbr 2 = TempSbr 3 = MincalcT	uint8	289c	10396	Not applicable
Zirconia.ProbeType	Type of Probe 25 = MMI 26 = AACC 27 = Dray 28 = Accu 29 = SSI 30 = MacD 31 = Bosch 32 = Barber 33 = ferono 34 = PrbmV 35 = Eurotherm	uint8	2880	10368	Not applicable
Zirconia.ProcFactor	Process Factor (Value defined by probe manufacturer)	float32	2888	10376	1dp
Zirconia.PVFrozen	1 = PV frozen	bool	2897	10391	Not applicable
Zirconia.RemGasEn	1 = Enable use of remote gas reference	bool	2884	10372	Not applicable
Zirconia.RemGasRef	Remote Gas Reference Value	float32	2883	10371	1dp
Zirconia.SootAlm	1 = Soot alarm active	bool	2895	10389	Not applicable
Zirconia.TempInput	Probe temperature Input	float32	288e	10382	0dp
Zirconia.TempOffset	Temperature Offset	float32	288f	10383	Set by Zirconia.Resolution
Zirconia.Time2Clean	Time To Next Clean	time_t	289b	10395	Set by Network.Modbus.TimeFormat
Zirconia.Tolerance	Sooting Tolerance	float32	2887	10375	1dp
Zirconia.WrkGas	Working Reference Gas Value	float32	2885	10373	1dp

6 iTOOLS

iTools software running on a pc allows quick and easy access to the configuration of the unit. The parameters used are generally the same as those described in section 4 above, with the addition of various diagnostic parameters.

iTools also gives the user the ability to create software wiring between function blocks, such wiring being carried out using the Graphical wiring Editor feature.

A further feature - the display mode 'Promote List', is populated using iTools - see section 3.4.7 for details.

In addition to the guidance given here, there are two on-line Help systems available within iTools: Parameter help and iTools help. Parameter help is accessed by clicking on 'Help' in the toolbar (opens the complete parameter help system), by right-clicking on a parameter and selecting 'Parameter Help' from the resulting context menu, or by clicking on the Help menu and selecting 'Device Help'. iTools help is accessed by clicking on the Help menu, and selecting 'Contents'. iTools help is also available in manual format under part number HA028838, either as a physical manual or as a pdf file.

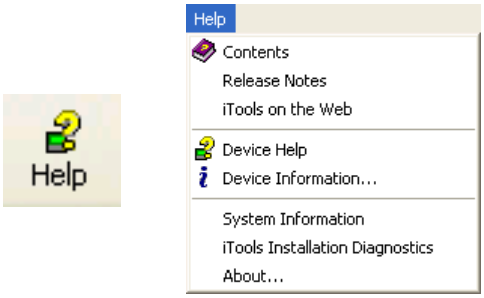


Figure 6 Help access

6.1 iTools CONNECTION

The following descriptions assume that iTools software has been correctly installed on the pc.

6.1.1 Ethernet (Modbus TCP) communications

Note: the following description is based on windows XP. Windows 'Vista' is similar.

It is first necessary to determine the IP address of the unit, as described under 'Network.Interface' in section 4.2.1.

Once the Ethernet link has been correctly installed, carry out the following actions at the pc:

1. Click on 'Start'
2. Click on 'Control Panel'. (If Control Panel opens in 'Category View' select 'Classic View' instead.)
3. Double-click on 'iTools'.
4. Click on the TCP/IP tab in the Registry settings configuration.
5. Click on 'Add...' The 'New TCP/IP Port' dialogue box opens.
6. Type-in a name for the port, then click 'Add...' again
7. Type the IP address of the unit in the 'Edit Host' box which appears. Click OK.
8. Check the details in the 'New TCP/IP Port' box, then click on 'OK'.
9. Click on 'OK' in the 'Registry settings' box to confirm the new port.

(Continued)

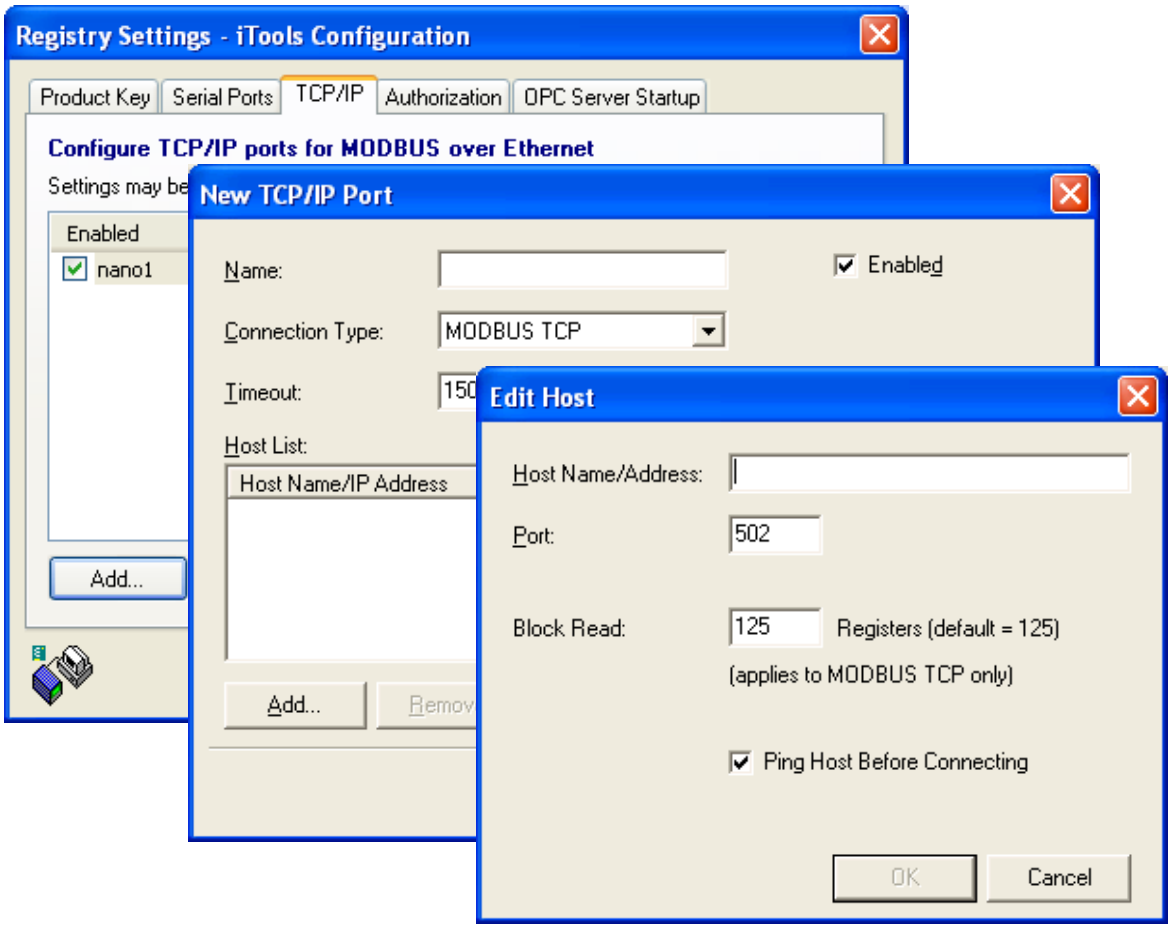


Figure 6.1.1a Adding a new Ethernet port

6.1.1 ETHERNET (TCP/IP) COMMUNICATIONS (Cont.)

To check that the pc can now communicate with the instrument, Click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'

when the Command Prompt box appears, type in: Ping<Space>IP1.IP2.IP3.IP4<Enter> (where IP1 to IP4 are the IP address of the instrument).

If the Ethernet link to the instrument is operating correctly, the 'successful' reply arrives. Otherwise, the 'failed' reply arrives, in which case, the Ethernet link, IP address, and pc port details should be verified.

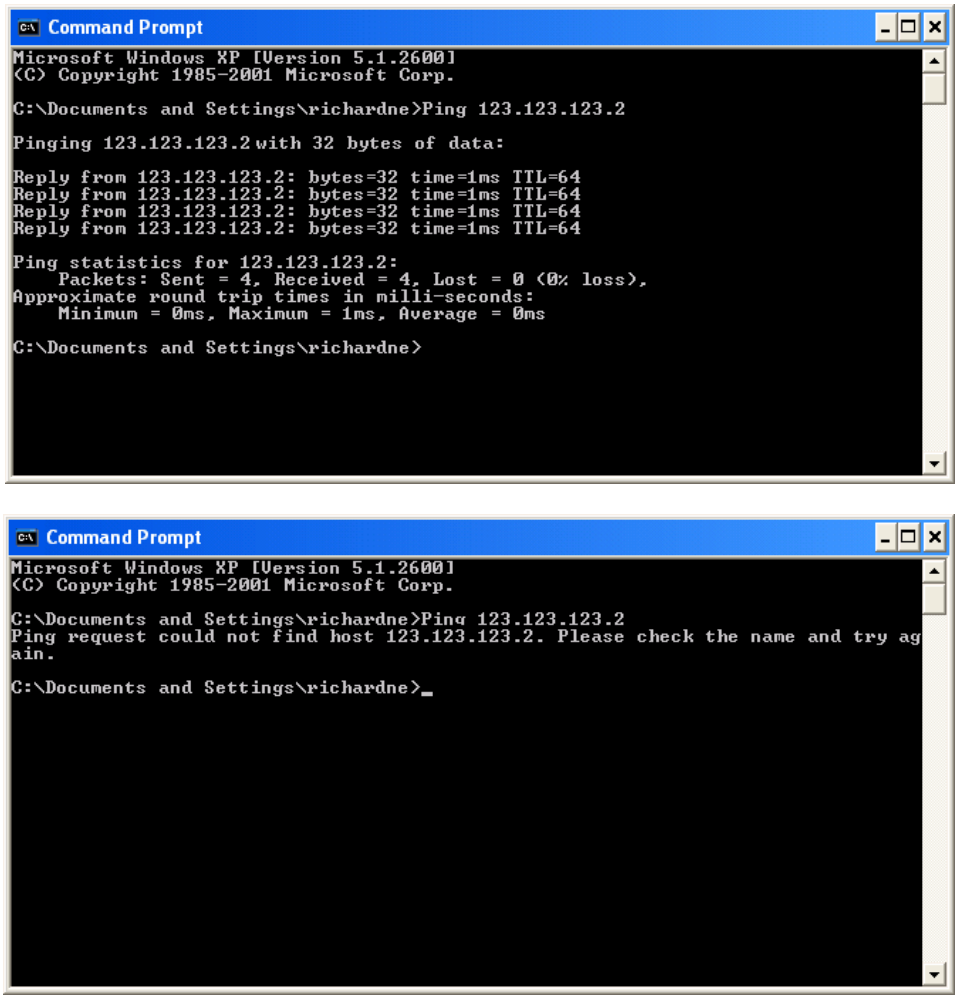

Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\richardne>Ping 123.123.123.2
Pinging 123.123.123.2 with 32 bytes of data:
Reply from 123.123.123.2: bytes=32 time=1ms TTL=64
Reply from 123.123.123.2: bytes=32 time=1ms TTL=64
Reply from 123.123.123.2: bytes=32 time=1ms TTL=64
Reply from 123.123.123.2: bytes=32 time=1ms TTL=64
Ping statistics for 123.123.123.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\Documents and Settings\richardne>
Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\richardne>Ping 123.123.123.2
Ping request could not find host 123.123.123.2. Please check the name and try ag
ain.
C:\Documents and Settings\richardne>_

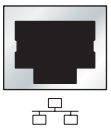
Figure 6.1.1b Command prompt 'Ping' screens (typical)

Once the Ethernet link to the instrument has been verified, iTools can be started (or shut down and restarted), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

See section 6.2 for more details of the scan procedure.

6.1.2 Direct Connection

This section describes how to connect a pc directly to the instrument.



PC Ethernet connector.

WIRING

Connection is made from the Ethernet connector at the rear of the Instrument to an Ethernet RJ45 connector, usually located at the rear of the pc. The cable can be either a 'cross-over' or 'straight through' type.

Once wired correctly, and powered up, it is necessary to enter a suitable IP address and subnet mask into the Comms configuration of the Driver Module. This information can be found as follows:

1. At the pc, click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'
2. When the Command Prompt box appears, type IPConfig<Enter>

   The response is a display, such as that shown below, giving the IP address and Subnet mask of the pc. Choose an address in the range covered by these two values.

   A subnet mask element of 255 means that the equivalent element of the IP address must be used unchanged. A subnet mask element of 0 means that the equivalent element of the IP address may take any value between 1 and 255 (0 is not allowed). In the example below, the range of IP addresses which may be chosen for the Driver Module is 123.123.123.2 to 123.123.123.255. (123.123.123.0 is not allowed and 123.123.123.1 is the same as the pc's address, and may therefore not be used.)

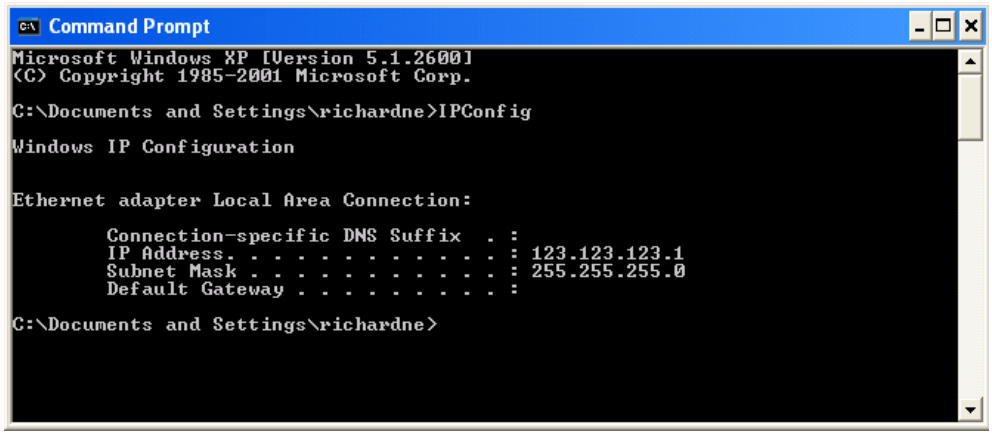

Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\richardne>IPConfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . :
IP Address. . . . . : 123.123.123.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :
C:\Documents and Settings\richardne>

Figure 6.1.2b IP Config command

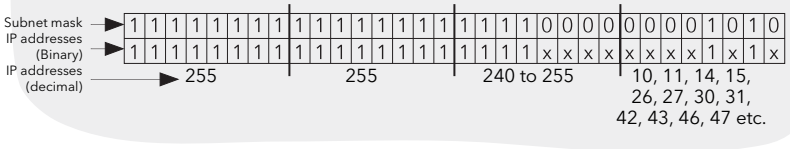
3. In Network.Interface configuration (section 4.2.1) enter the selected IP address and the subnet mask (as it appears in the command prompt window) in the relevant parts of the menu.
4. Check communications by 'pinging' as described in section 6.1.1, above.

Once the link to the instrument has been verified, iTools can be started (or shut down and re-started), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

See section 6.2 for more details of the scan procedure.

Subnet Masks and IP addresses.

Subnet Masks are most readily understood when looked at in binary format.
For example, a mask of 255.255.240.10 can be re-written as:
11111111.11111111.11110000.00001010. In such a case, IP addresses
11111111.11111111.1111xxxx.xxxx1x1x would be recognised (where x can be either a 0 or



6.2 SCANNING FOR INSTRUMENTS

Clicking on the 'Scan' toolbar icon causes a dialogue box (shown below) to appear. This allows the user to define a search range of addresses.

Notes:

1. The relevant instrument address is that entered in the Network.Modbus configuration item (section 4.2.4, and it can take any value between 1 and 254 inclusive, as long as it is unique to the comms link.
2. The default selection (Scan all device addresses...) will detect any instrument on the serial link, which has a valid address.

As the search progresses, any instruments detected by the scan appear as thumbnails (faceplates) in the 'Panel Views' area, normally located at the bottom of the iTools screen. (options/Panel Views position allows this area to be moved to the top of the window, or the Close icon can be used to close it. Once closed it can be re-opened by clicking on 'Panel Views' in the 'View' menu.)

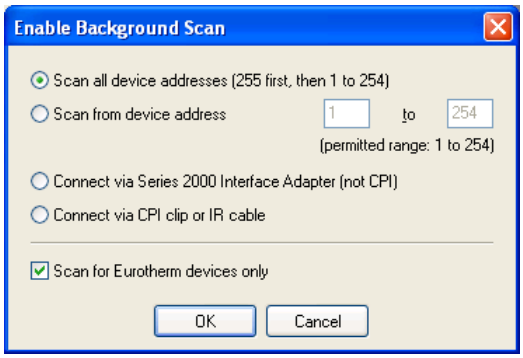


Figure 6.2a Scan range enable

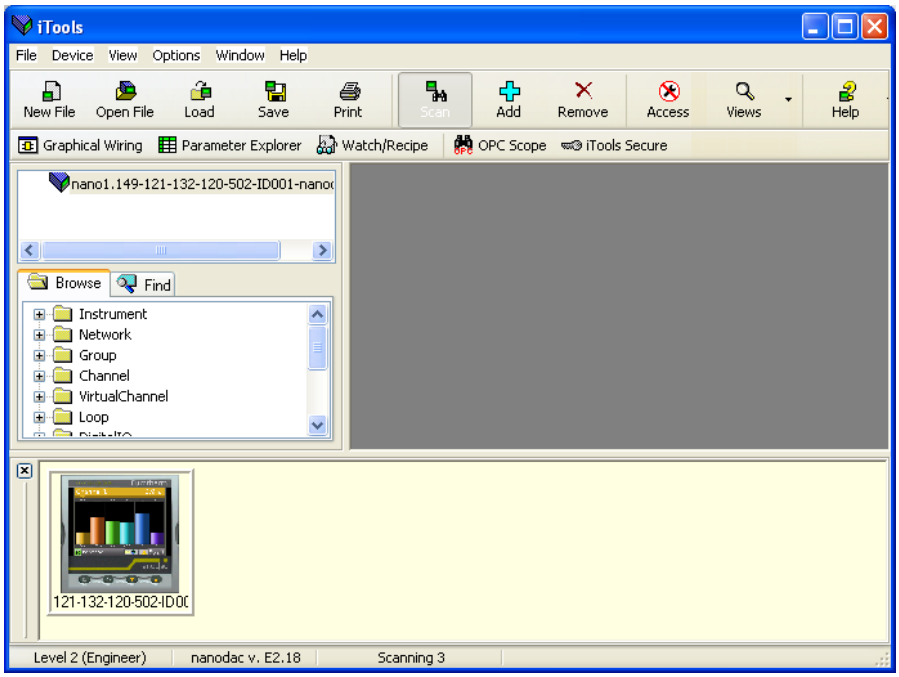


Figure 6.2b iTools initial window with one instrument detected

Once the instrument has been detected stop the scan. When the instrument has synchronised, click on the 'Access' button to enter configuration mode (a password might be required). Once the editing session is complete, click on the Access button again to quit configuration mode.

6.3 GRAPHICAL WIRING EDITOR Graphical Wiring

Clicking on the Graphical wiring Editor tool bar icon causes the Graphical wiring window for the current instrument configuration to open.

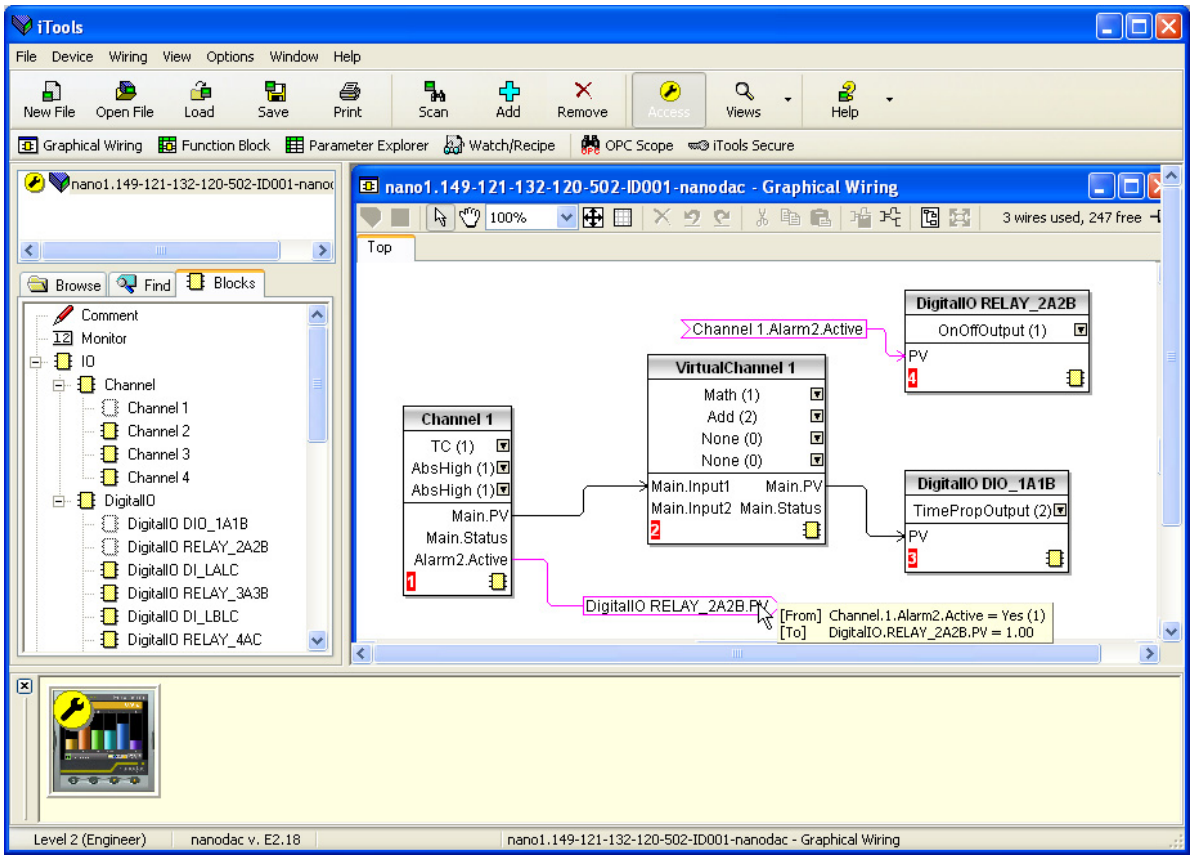


Figure 6.3 Graphical wiring Editor

The graphical wiring editor allows:

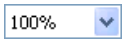
1. Function blocks, notes, comments etc. to be 'drag and dropped' into the wiring diagram from the tree list (left pane).
2. Parameters to be wired to one another by clicking on the output, the clicking on the required input.
3. Viewing and/or editing of parameter values by right-clicking on a function block and selecting 'Function Block View'.
4. The user to select parameter lists and to switch between parameter and wiring editors.
5. Completed wiring to be downloaded to the instrument (function blocks and wiring items with dashed outlines are new, or have been edited since the last download).

6.3.1 Tool bar

Download wiring to instrument

Mouse select. Select normal mouse operation. Mutually exclusive with 'Mouse Pan' below.

Mouse Pan. When active, this causes the mouse cursor to change to a hand-shaped icon. Allows the graphical wiring diagram to be click-dragged within the GWE window aperture.



Zoom. Allows the magnification factor of the wiring diagram to be selected

Pan tool. Whilst left clicked, the cursor appears as a rectangle showing which part of the wiring diagram is currently displayed. Click dragging allows the rectangle to be moved freely about the diagram. The size of the rectangle depends on the zoom setting.

Show/Hide grid. This toggles an alignment grid on and off.

Undo, redo.Allows the user to undo the last action, or, once an undo action has taken place, to undo the undo. Short cuts are <Ctrl>+<Z. for undo; <Ctrl>+<V, for undo

Cut, Copy, Paste. Normal Cut (copy and delete), Copy (copy without delete) and Paste (insert into) functions. Shortcuts are: <Ctrl> + <X> for 'Cut'; <Ctrl> + <C> for copy and <Ctrl> + <V> for Paste.

Copy diagram fragment; Paste diagram fragment. Allows a part of the wiring diagram to be selected, named and be saved to file. The fragment may then be pasted into any wiring diagram, including the source diagram

Create compound; Flatten compound. These two icons allow compounds to be created and 'un created' (flattened).

6.3.2 Wiring editor operating details

COMPONENT SELECTION

Single wires are shown with boxes at 'corners' when selected. When more than one wire is selected, as part of a group, the wire colour changes to magenta. All other items have a dashed line drawn round them when selected.

Clicking on a single item selects it. An Item can be added to the selection by holding down the control key (ctrl) whilst clicking on the item. (A selected item can be deselected in the same way.) If a block is selected, then all its associated wires are also selected.

Alternatively, the mouse can be click-dragged on the background to create a 'rubber band' round the relevant area; anything within this area being selected when the mouse is released.

<Ctrl>+<A> selects all items on the active diagram.

BLOCK EXECUTION ORDER

The order in which the blocks are executed by the instrument depends on the way in which they are wired. Each block displays its place in its sequence in a coloured block in the bottom left-hand corner (figure 6.3.2a).

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

FUNCTION BLOCKS

A Function Block is an algorithm which may be wired to and from other function blocks to make a control strategy. Each function block has inputs and outputs. Any parameter may be wired from, but only parameters that are alterable in Operator Mode may we wired to. A function block includes any parameters that are needed to configure or operate the algorithm. The inputs and outputs which are considered to be of most use are always shown. In most cases all of these need to be wired before the block can perform a useful task.

If a function block is not faded in the tree (left hand pane) it can be dragged onto the diagram. The block can be dragged around the diagram using the mouse.

A Channel block is shown below as an example. When block type information is alterable (as in this case) click on the box with the down arrow in it to display a dialogue box allowing the value to be edited.

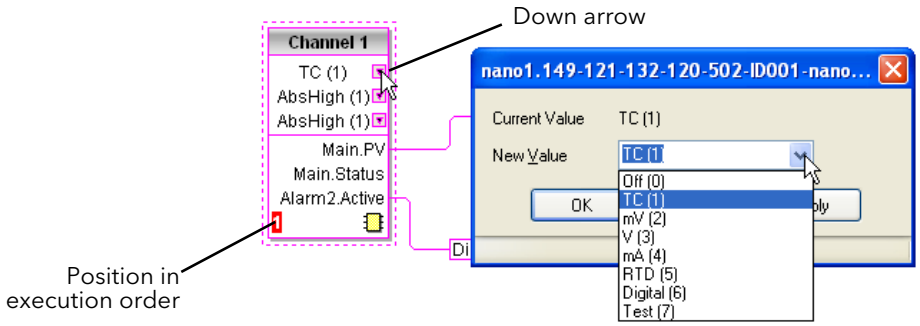


Figure 6.3.2a Function block example

If it is required to wire from a parameter, which is not shown as a recommended output, click on the 'Click to Select Output' icon in the bottom right hand corner to display a full list of parameters in the block (figure 6.3.2c, below). Click on one of these to start a wire.

FUNCTION BLOCK CONTEXT MENU

Right click in the function block to display the context menu.

Function block view — Displays a list of parameters associated with the function block. 'Hidden' parameters can be displayed by de-selecting 'Hide Parameters and Lists when not Relevant in the options menu 'Parameter availability setting...' item

Re-Route wires — Redraws all wiring associated with the function block.

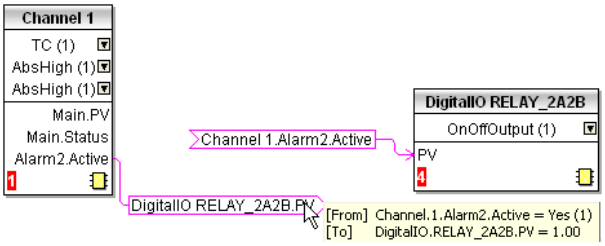
Re-route input wires — Redraws all input wiring associated with the function block

Re-route output wires — Redraws all output wiring associated with the function block.

Show wiring using tags

Wires are not drawn, but their start and end destinations are indicated by tags instead. Reduces wire clutter in diagrams where source and destination are widely separated.

Hovering the cursor over the tag shows both its source and destination parameters and their values



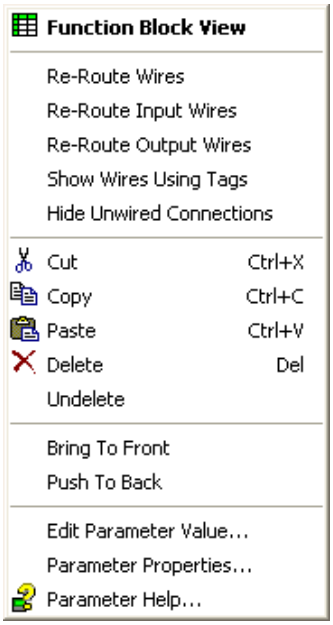


Figure 6.3.2b Function block context menu

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

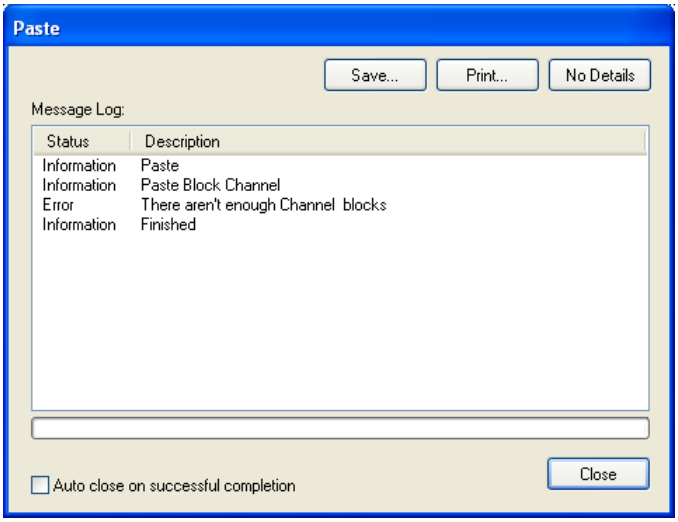
FUNCTION BLOCK CONTEXT MENU (Cont.)

Hide unwanted connections
: Causes the display to include only wired items.

Cut
: Allows one or more selected items to be moved to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items are greyed out, and function blocks and wires are shown dashed until next download, after which they are removed from the diagram. Short cut = <Ctrl>+<X>. Cut operations carried out since the last download can be 'undone' by using the 'Undo' tool bar icon, by selecting 'Undelete' or by using the short cut <Ctrl>+<Z>.

Copy
: Allows one or more selected items to be copied to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items remain in the current wiring diagram. Short cut = <Ctrl>+<C>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, an error display appears showing details of which items couldn't be copied.

Paste
: Copies items from the Clipboard to the current wiring diagram. Short cut = <Ctrl>+<V>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, a Paste error display appears showing details of those items which could not be copied.



Delete
: Marks all selected items for deletion. Such items are shown dashed until next download, after which they are removed from the diagram. Short cut = <Del>.

Undelete
: Reverses 'Delete' and 'Cut' operations carried out on selected item(s) since the last download.

Bring to Front
: Brings selected items to the front of the diagram.

Push to Back
: Sends the selected items to the back of the diagram.

Edit Parameter Value...
: This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to edit the parameter value.

Parameter Properties
: This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to view the parameter properties, and also, to view the parameter Help (by clicking on the 'Help' tab).

Parameter Help
: Produces Parameter Properties and Help information for the selected function block or parameter, depending on the hover position of the cursor, when the right-click occurs.

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

WIRES

To make a wire

1. Drag two (or more) blocks onto the diagram from the function block tree.
2. Start a wire by either clicking on a recommended output or clicking on the 'Click to Select output' icon at the bottom right corner of the block to bring up the connection dialogue, and clicking on the required parameter. Recommended connections are shown with a green plug symbol; other parameters which are available being shown in yellow. Clicking on the red button causes all parameters to be shown. To dismiss the connection dialogue either press the escape key on the keyboard, or click the cross at the bottom left of the dialogue box.
3. Once the wire has started a dashed wire is drawn from the output to the current mouse position. To complete the wire click on the required destination parameter.
4. Wires remain dashed until they are downloaded

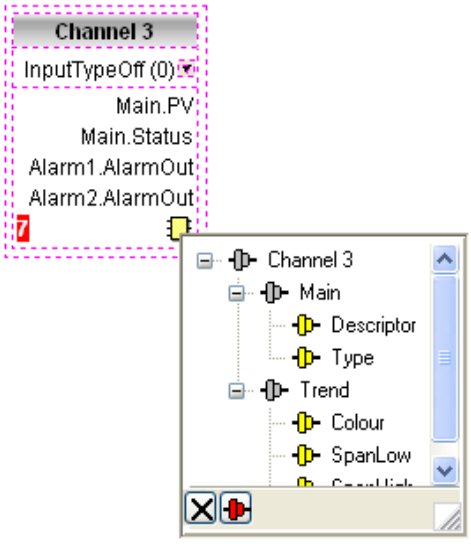


Figure 6.3.2c Output selection dialogue box.

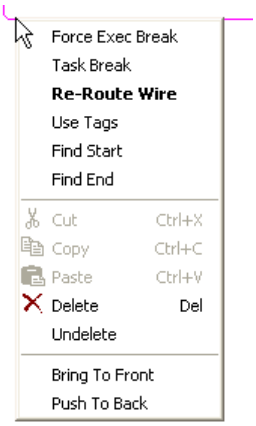
Routing wires

When a wire is placed it is auto-routed. The auto routing algorithm searches for a clear path between the two blocks. A wire can be auto-routed again using the context menus or by double clicking the wire. A wire segment can be edited manually by click-dragging. If the block to which it is connected is moved, the end of the wire moves with it, retaining as much of the path as possible.

If a wire is selected by clicking on it, it is drawn with small boxes on its corners.

Wire Context Menu

Right click on a wire to display the wire block context menu:



Force Exec Break	When wires form a loop, a break point must be introduced, where the value written to the block comes from a source which was last executed during the previous cycle. A break is automatically placed by iTools, and appears in red. Force Exec Break allows the user to define where a break must be placed. Surplus breaks appear in black.
Re-Route wire	Replaces the current wire route with a new route generated from scratch.
Use Tags	Toggles between wire and tag mode between parameters. Tag mode is useful for sources and destinations which are widely separated.
Find Start	Goes to the source of the wire.
Find End	Goes to the destination of the wire.
Cut, Copy, Paste	Not used in this context.
Delete	Marks the wire for deletion. The wire is redrawn as a dashed line (or dashed tags) until next download. Operation can be reversed until after next download.
Undelete	Reverses the effect of the Delete operation up until the next download, after which, Undelete is disabled.
Bring to Front	Brings the wire to the front of the diagram.
Push to Back	Sends the wire to the back of the diagram.

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

Wire Colours

Black	Normal functioning wire
Red	The wire is connected to a non-changeable parameter. Values are rejected by the destination block.
Magenta	A normal functioning wire is being hovered-over by the mouse cursor.
Purple	A red wire is being hovered-over by the mouse cursor.
Green	New Wire (dashed green wire changes to solid black after being downloaded.)

COMMENTS

Comments are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. As soon as the mouse is released, a dialogue box opens to allow the comment text to be entered.

Carriage returns are used to control the width of the comment. Once text entry is complete, 'OK' causes the comment to appear on the diagram. There are no restrictions on the size of a comment. Comments are saved to the instrument along with the diagram layout information.

Comments can be linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the comment box and then clicking again on the required block or wire. A dashed line is drawn to the top of the block or to the selected wire segment (figure 6.3.2f).

Note: Once the comment has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the comment box.

Comment Context Menu

Edit	Opens the Comment dialogue box to allow the comment text to be edited.
Unlink	Deletes the current link from the comment.
Cut	Moves the comment to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the comment from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a comment from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the comment for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.

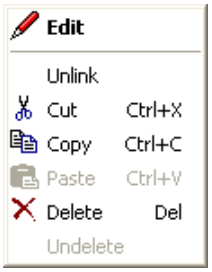


Figure 6.3.2e
Comment context menu

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

MONITORS

Monitor points are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. A monitor shows the current value (updated at the iTools parameter list update rate) of the parameter to which it is linked. By default the name of the parameter is shown. To hide the parameter name either double click on the monitor box or 'Show Names' in the context (right-click) menu can be used to toggle the parameter name on and off.

Monitors are linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the box and then clicking again on the required parameter. A dashed line is drawn to the top of the block or the selected wire segment.

Note: Once the monitor has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the monitor box.

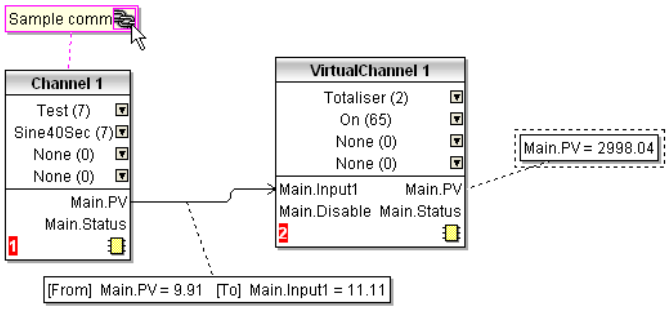


Figure 6.3.2f Comment and Monitor appearance

Monitor Context Menu

Show names	Toggles parameter names on and off in the monitor box.
Unlink	Deletes the current link from the monitor.
Cut	Moves the monitor to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the monitor from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a monitor from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the monitor for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.
Bring to Front	Moves the item to the 'top' layer of the diagram.
Push to Back	Moves the item to the 'bottom' layer of the diagram.
Parameter Help	Shows parameter help for the item.

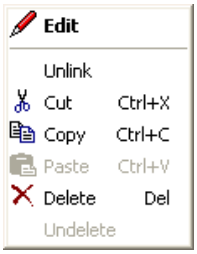


Figure 6.3.2g
Monitor context menu

DOWNLOADING

When the wiring editor is opened the current wiring and diagram layout is read from the instrument. No changes are made to the instrument function block execution or wiring until the download button is pressed. Any changes made using the operator interface after the editor is opened are lost on download.

When a block is dropped onto the diagram, instrument parameters are changed to make the parameters for that block available. If changes are made and the editor is closed without saving them there is a delay while the editor clears these parameters.

During download, the wiring is written to the instrument which then calculates the block execution order and starts executing the blocks. The diagram layout including comments and monitors is then written into instrument flash memory along with the current editor settings. When the editor is reopened, the diagram is shown positioned as it was when it was last downloaded.

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

COLOURS

Items on the diagram are coloured as follows:

Red	Items which totally or partially obscure other items and items which are totally or partially obscured by other items. Wires that are connected to unalterable or non-available parameters. Execution breaks.
Blue	Non-available parameters in function blocks.
Green	Items added to the diagram since last download are shown as green dashed lines.
Magenta	All selected items, or any item over which the cursor is hovering.
Purple	Red wires when being hovered over by the mouse cursor.
Black	All items added to the diagram before the last download. Redundant execution breaks. Monitor and comment text.

DIAGRAM CONTEXT MENU

Cut	Active only when the right click occurs within the bounding rectangle which appears when more than one item is selected. Moves the selection off the diagram to the Clipboard. Short cut = <Ctrl>+<X>.
Copy	As for 'Cut', but the selection is copied, leaving the original on the diagram. Short cut = <Ctrl>+<C>.
Paste	Copies the contents of the Clipboard to the diagram. Short cut = <Ctrl>+<V>.
Re-Route wires	Reroutes all selected wires. If no wires are selected, all wires are re-routed.
Align Tops	Aligns the tops of all blocks in the selected area.
Align Lefts	Aligns the left edges of all blocks in the selected area.
Space Evenly	Spaces selected items such that their top left corners are spaced evenly across the width of the diagram. Click on the item which is to be the left-most item, then <Ctrl>+<left click> the remaining items in the order in which they are to appear.
Delete	Marks the item for deletion at next download time. Can be 'Undeleted' up until download occurs.
Undelete	Reverses the action of 'Delete' on the selected item.
Select All	Selects all items on the current diagram.
Create Compound	Active only when the right click occurs, in the top level diagram, within the bounding rectangle which appears when more than one item is selected. Creates a new wiring diagram as described in 'Compound', below.
Rename	Allows a new name to entered for the current wiring diagram. This name appears in the relevant tab.
Copy Graphic	Copies the selected items (or the whole diagram if no items are selected) to the clipboard as a Windows metafile, suitable for pasting into a documentation application. Wiring entering/leaving the selection (if any) are drawn in tag mode.
Save Graphic...	As for 'Copy Graphic' above, but saves to a user-specified file location instead of the clipboard.
Copy Fragment To File...	Copies selected items to a user-named file in folder 'My iTools Wiring Fragments' located in 'My Documents'.
Paste Fragment From File	Allows the user to select a stored fragment for inclusion in the wiring diagram.
Centre	Places the display window at the centre of the selected items. If 'Select All' has previously been clicked-on, then the display widow is placed over the centre of the diagram.

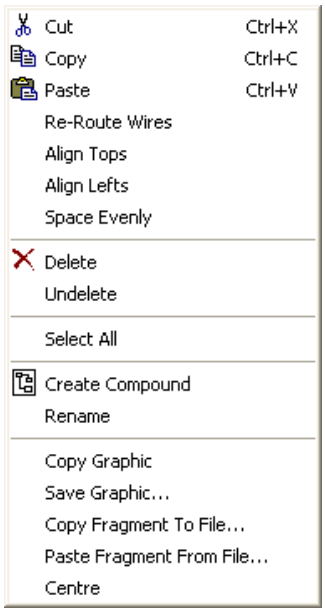


Figure 6.3.2h
Diagram context menu

6.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

COMPOUNDS

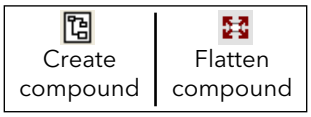
Compounds are used to simplify the top level wiring diagram, by allowing the placing of any number of function blocks within one 'box', the inputs and outputs of which operate in the same way as those of a normal function block.

Each time a compound is created, a new tab appears at the top of the wiring diagram. Initially compounds and their tabs are named 'Compound 1', 'Compound 2', etc. but they can be renamed by right clicking either on the compound in the top level diagram, or anywhere within an open Compound, selecting 'Rename' and typing in the required text string (16 characters max.).

Compounds cannot contain other compounds (i.e. they can be created only in the top level diagram).

Compound creation

1. Empty compounds are created within the top level diagram by clicking on the 'Create Compound' tool bar icon.
2. Compounds can also be created by highlighting one or more function blocks in the top level diagram and then clicking on the 'Create Compound' tool bar icon. The highlighted items are moved from the top level diagram into a new compound.



3. Compounds are 'uncreated' (flattened), by highlighting the relevant item in the top level menu and then clicking on the 'Flatten Compound' tool bar icon. All the items previously contained within the compound appear on the top level diagram.
4. Wiring between top level and compound parameters is carried out by clicking on the source parameter, then clicking on the compound (or the compound tab) and then clicking on the destination parameter. Wiring from a compound parameter to a top level parameter or from compound to compound is carried out in similar manner.
5. Unused function blocks can be moved into compounds by dragging from the tree view. Existing blocks can be dragged from the top level diagram, or from another compound, onto the tab associated with the destination compound. Blocks are moved out of compounds to the top level diagram or to another compound in a similar way. Function blocks can also be 'cut and pasted'.
6. Default compound names (e.g. 'Compound 2') are used only once, so that if, for example, Compounds 1 and 2 have been created, and Compound 2 is subsequently deleted, then the next compound to be created will be named 'Compound 3'.
7. Top level elements can be click-dragged into compounds.

TOOL TIPS

Hovering the cursor over the block displays 'tooltips' describing that part of the block beneath the cursor. For function block parameters the tooltip shows the parameter description, its OPC name, and, if downloaded, its value. Similar tooltips are shown when hovering over inputs, outputs and over many other items on the iTools screen.

A Function Block is enabled by dragging the block onto the diagram, wiring it, and finally downloading it to the instrument. Initially blocks and associated wires are drawn with dashed lines, and when in this state the parameter list for the block is enabled but the block is not executed by the instrument.

The block is added to the instrument function block execution list when the 'Download' icon is operated and the items are redrawn using solid lines.

If a block which has been downloaded is deleted, it is shown on the diagram in a ghosted form until the download button is pressed. (This is because it and any wires to/from it are still being executed in the instrument. On download it will be removed from the instrument execution list and the diagram.) A ghosted block can be 'undeleted' as described in 'Context menu', above.

When a dashed block is deleted it is removed immediately.

6.4 PARAMETER EXPLORER Parameter Explorer

This view can be displayed:

1. by clicking on the 'Parameter Explorer' toolbar icon,
2. by double clicking on the relevant block in the tree pane or in the graphical wiring editor
3. by selecting 'Function Block View' from the Function block context menu in the Graphical wiring Editor.
4. by selecting 'parameter Explorer from the 'View' menu
5. by using the short cut <Alt>+<Enter>

In each case the function block parameters appear in the iTools window in tabular form, such as the example in figure 6.4a, below.

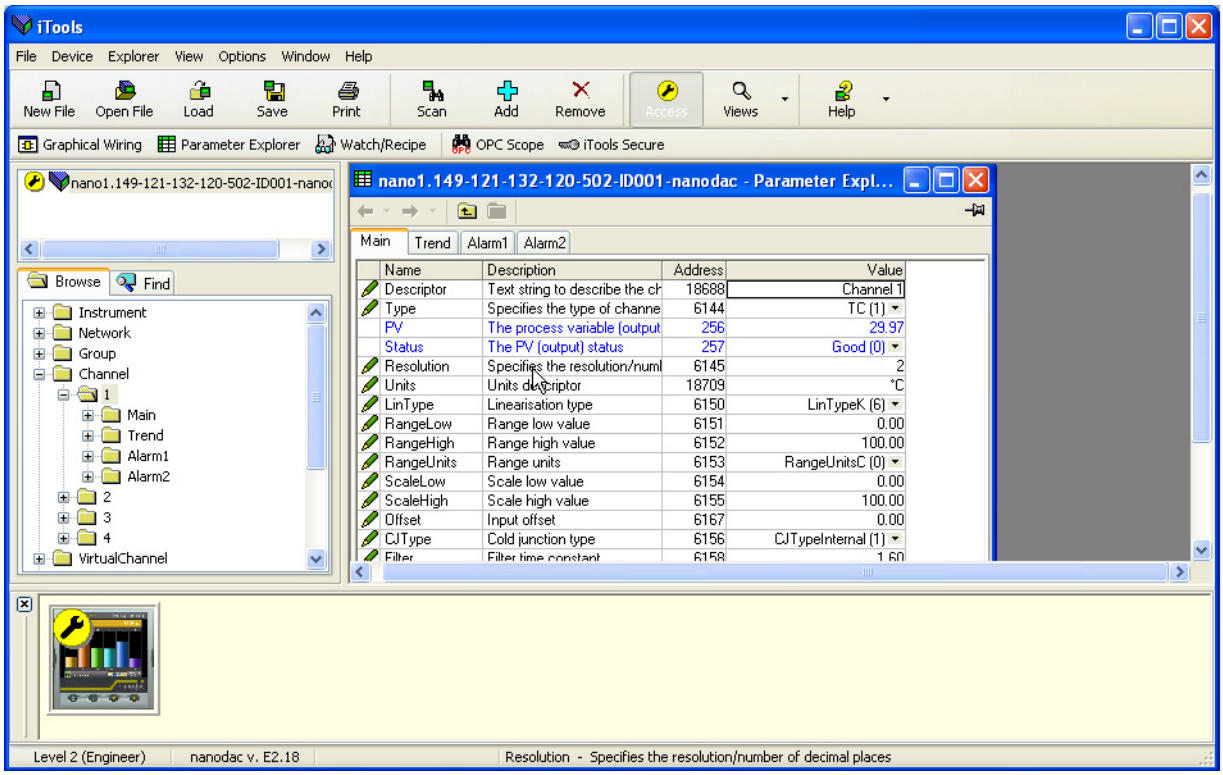

iTools
File Device Explorer View Options Window Help
New File Open File Load Save Print Scan Add Remove Access Views Help
Graphical Wiring Parameter Explorer Watch/Recipe OPC Scope iTools Secure
nano1.149-121-132-120-502-ID001-nanodac - Parameter Expl...
Main Trend Alarm1 Alarm2
Name Description Address Value
Descriptor Text string to describe the ch 18688 Channel 1
Type Specifies the type of channe 6144 TC (1)
PV The process variable (output 256 29.97
Status The PV (output) status 257 Good (0)
Resolution Specifies the resolution/numl 6145 2
Units Units descriptor 18709 °C
LinType Linearisation type 6150 LinTypeK (6)
RangeLow Range low value 6151 0.00
RangeHigh Range high value 6152 100.00
RangeUnits Range units 6153 RangeUnitsC (0)
ScaleLow Scale low value 6154 0.00
ScaleHigh Scale high value 6155 100.00
Offset Input offset 6167 0.00
CJType Cold junction type 6156 CJTypeInternal (1)
Browse Find
Instrument
Network
Group
Channel
1
Main
Trend
Alarm1
Alarm2
2
3
4
VirtualChannel
Level 2 (Engineer)
nanodac v. E2.18
Resolution - Specifies the resolution/number of decimal places

Figure 6.4a Parameter table example

The figure above shows the default table layout. Columns can be added/deleted from the view using the 'Columns' item of the Explorer or context menus (figure 6.4b).

6.4 PARAMETER EXPLORER (Cont.)

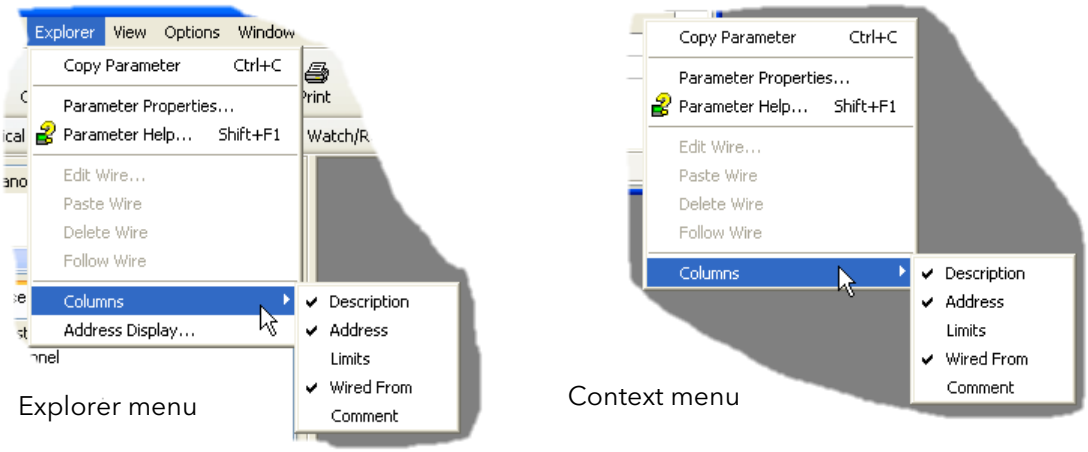
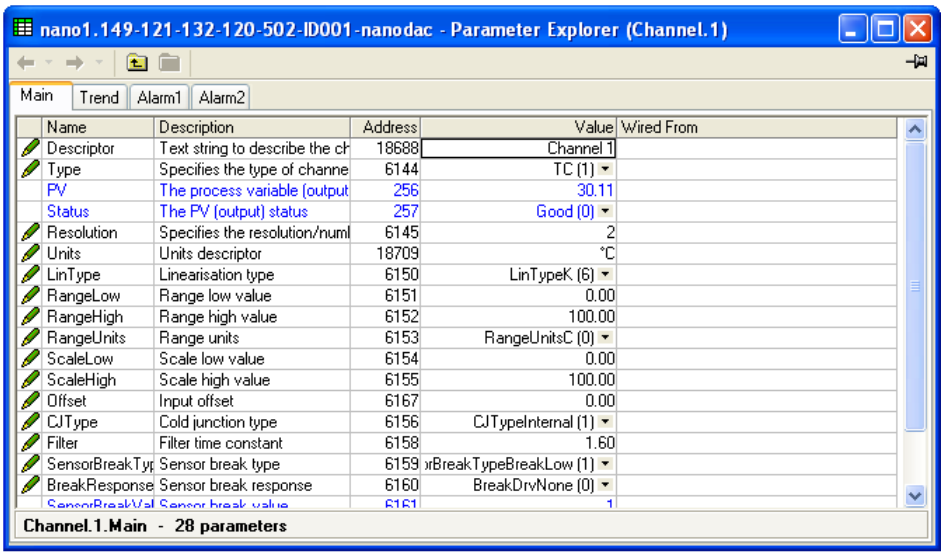


Figure 6.4b Column enable/disable

6.4.1 Parameter explorer detail

Figure 6.4.1a shows a typical parameter table. This particular parameter has a number of subfolders associated with it, and each of these is represented by a 'tab' across the top of the table.



Name	Description	Address	Value	Wired From
Descriptor	Text string to describe the ch	18688	Channel 1	
Type	Specifies the type of channe	6144	TC (1)	
PV	The process variable (output	256	30.11	
Status	The PV (output) status	257	Good (0)	
Resolution	Specifies the resolution/numl	6145	2	
Units	Units descriptor	18709	°C	
LinType	Linearisation type	6150	LinTypeK (6)	
RangeLow	Range low value	6151	0.00	
RangeHigh	Range high value	6152	100.00	
RangeUnits	Range units	6153	RangeUnitsC (0)	
ScaleLow	Scale low value	6154	0.00	
ScaleHigh	Scale high value	6155	100.00	
Offset	Input offset	6167	0.00	
CJType	Cold junction type	6156	CJTypeInternal (1)	
Filter	Filter time constant	6158	1.60	
SensorBreakTyp	Sensor break type	6159	rBreakTypeBreakLow (1)	
BreakResponse	Sensor break response	6160	BreakDrvNone (0)	

Figure 6.4.1a Typical parameter table

Notes:

1. Parameters in blue are non-editable (Read only). In the example above all the parameters are read only. Read/write parameters are in black and have a 'pencil' symbol in the 'read/Write access column at the left edge of the table. A number of such items are shown in figure 6.4.1a, above.
2. Columns. The default explorer window (figure 6.4a) contains the columns 'Name', 'Description', 'Address', 'Value', and 'Wired From'. As can be seen from figure 6.4b, the columns to be displayed can be selected, to a certain extent, using either the 'Explorer' menu or the context menu. 'Limits' have been enabled for the example above.
3. Hidden Parameters. By default, iTools hides parameters which are considered irrelevant in the current context. Such hidden parameters can be shown in the table using the 'Parameter availability' settings item of the options menu (figure 6.4.1b). Such items are displayed with a shaded background.
4. The full pathname for the displayed parameter list is shown at the bottom left hand corner of the window.

6.4.1 PARAMETER EXPLORER DETAIL (Cont.)

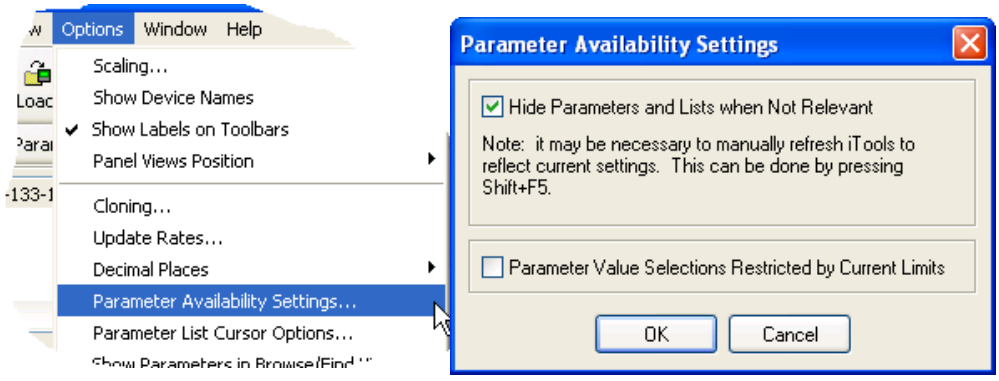


Figure 6.4.1b Show/Hide parameters

6.4.2 Explorer tools

A number of tool icons appear above the parameter list:

Back to: and Forward to:. The parameter explorer contains a history buffer of up to 10 lists that have been browsed in the current instance of the window. The 'Back to: (list name)' and 'Forward to: (list name)' icons allow easy retracing or repeating of the parameter list view sequence.
If the mouse cursor is hovered over the tool icon, the name of the parameter list which will appear if the icon is clicked-on appears. Clicking on the arrow head displays a pick list of up to 10 previously visited lists which the user can select. Short cut = <Ctrl>+<B> for 'Back to' or <Ctrl>+<F> for 'Forward to'.

Go Up a Level, Go Down a Level. For nested parameters, these buttons allow the user to navigate 'vertically' between levels. Short cut = <Ctrl>+<U> for 'Go Up a Level' or <Ctrl>+<D> for 'Go Down a Level'.

Push pin to give the window global scope. Clicking on this icon causes the current parameter list to be permanently displayed, even if another instrument becomes the 'current device'.

6.4.3 Context Menu

Copy Parameter Copies the clicked-on parameter to the clipboard

Parameter properties
Displays parameter properties for the clicked-on parameter

Parameter Help... Displays help information for the clicked-on parameter

Edit/Paste/Delete/Follow Wire
Not used in this application

Columns Allows the user to enable/disable a number of parameter table columns (figure 6.1.4b).

6.5 WATCH/RECIPE EDITOR Watch/Recipe

The watch/recipe editor is opened by clicking on the Watch/Recipe tool icon, by selecting 'Watch/Recipe' in the 'Views' menu or by using the short cut <Ctrl>+<A>. The window is in two parts: the left part containing the watch list; the right-hand part containing one or more data sets, initially empty and unnamed.

The Watch/Recipe window is used:

1. To monitor a list of parameters. This list can contain parameters from many different, and otherwise unrelated parameter lists within the same device. It cannot contain parameters from different devices.
2. To create 'data sets' of parameter values which can be selected and downloaded to the device in the sequence defined in the recipe. The same parameter may be used more than once in a recipe.

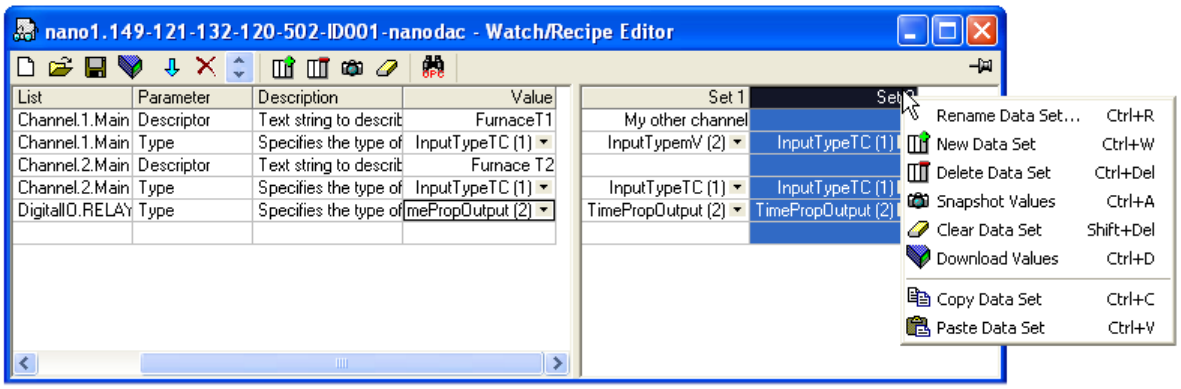


Figure 6.5 Watch/Recipe Editor window (with context menu)

6.5.1 Creating a Watch List

After opening the window, parameters can be added to it as described below. The values of the parameters update in real-time, allowing the user to monitor a number of values simultaneously.

ADDING PARAMETERS TO THE WATCH LIST

1. Parameters can be click-dragged into the watch list from another area of the iTools window (for example, the parameter explorer window, the graphical wiring editor, the browse tree). The parameter is placed either in an empty row at the bottom of the list, or if it is dragged on top of an already existing parameter, it is inserted above this parameter, with the remaining parameters being moved down one place.
2. Parameters can be dragged from one position in the list to another. In such a case, a copy of the parameter is produced, the source parameter remaining in its original position.
3. Parameters can be copied <Ctrl>+<C> and pasted <Ctrl>+<V> either within the list, or from a source external to it, for example the parameter browse window or the graphical wiring editor.
4. The 'Insert item...' tool button the 'Insert Parameter' item in the Recipe or context menu or the short cut <Insert> can be used to open a browse window from which a parameter is selected for insertion above the currently selected parameter.

DATA SET CREATION

Once all the required parameters have been added to the list, select the empty data set by clicking on the column header. Fill the data set with current values using one of the following methods:

1. Clicking on the 'Capture current values into a data set' tool icon (also known as the 'Snapshot Values' tool).
2. Selecting 'Snapshot Values' from the Recipe or Context (right-click) menu.
3. Using the short cut <Ctrl>+<A>.

6.5.1 CREATING A WATCH LIST (Cont.)

DATA SET CREATION (Cont.)

Individual data values can now be edited by typing directly into the grid cells. Data values can be left blank or cleared, in which case, no values will be written for those parameters at download. Data values are cleared by deleting all the characters in the cell then either moving to a different cell or typing <Enter>.

The set is called 'Set 1' by default, but it can be renamed by either by using the 'Rename data set...' item in the Recipe or context menus, or by using the short cut <Ctrl>+<R>.

New, empty data sets can be added using one of the following:

1. Clicking on the 'Create a new empty data set' toolbar icon.
2. Selecting 'New Data Set' in the Recipe or context menus
3. Using the short cut <Ctrl>+<W>

Once created, the data sets are edited as described above.

Finally, once all the required data sets have been created, edited and saved, they can be downloaded the instrument, one at a time, using the Download tool, the 'Download Values' item in the Recipe or context menus, or the short cut <Ctrl>+<D>.

6.5.2 Watch Recipe toolbar icons

Create a new watch/recipe list. Creates a new list by clearing out all parameters and data sets from an open window. If the current list has not been saved, confirmation is requested. Short cut <ctrl>+<N>

Open an existing watch/recipe file. If the current list or data set has not been saved, confirmation is requested. A file dialogue box then opens allowing the user to select a file to be opened. Short cut <ctrl>+<O>

Save the current watch/recipe list. Allows the current set to be saved to a user specified location. Short cut <ctrl>+<S>.

Download the selected data set to the device. Short cut <ctrl>+<D>

Insert item ahead of selected item. Short cut <Insert>.

Remove recipe parameter. Short cut <ctrl>+<Delete>.

Move selected item. Up arrow moves selected parameter up the list; down arrow move the selected parameter down the list.

Create a new empty data set. Short cut <ctrl>+<w>.

Delete an empty data set. Short cut <ctrl>+<Delete>

Capture current values into a data set. Fills the selected data set with values. Short cut <ctrl>+<A>.

Clear the selected data set. Removes values from the selected data set. Short cut <Shift>+<Delete>.

Open OPC Scope. Opens a separate utility that allows trending, data logging and Dynamic Data Exchange (DDE). OPC Scope is an OPC explorer program that can connect to any OPC server that is in the windows registry.
(OPC is an acronym for 'OLE for Process Control, where OLE stands for 'Object Linking and Embedding'.)

6.5.3 Watch/Recipe Context Menu

The Watch/Recipe Context menu items have the same functions as described above for toolbar items.

7 USER WIRING

User wiring, created from the instrument front panel, allows parameters to be wired together so that, for example, a counter can be configured to be incremented when an alarm goes active. This can be used as an alternative to iTools.

This section is presented as two examples that show the general techniques used to create and delete wires from the instrument user interface.

Notes:

1. These examples refer to Channel Configuration and to Virtual Channel configuration, descriptions of which are to be found in sections 4.4 and 4.5 respectively.
2. The destination parameter field has a small green triangle at the top left corner to indicate that it has a wire routed to it. 3A/3B (Relay)

7.1 DRIVE RELAY EXAMPLE

To drive the relay whose terminal contacts are 3A/3B, whilst the temperature being measured by Channel 2 exceeds 30°C. For this example Channel 2 alarm 1 and a hysteresis of 4°C will be used.

1. In channel 2, Alarm 1 page (see note), set the following parameters:
   Type: Abs. High
   Threshold: 30
   Hysteresis: 4
   Latch: None
   Block: Off
   Dwell:00:00:00
   Acknowledge: No

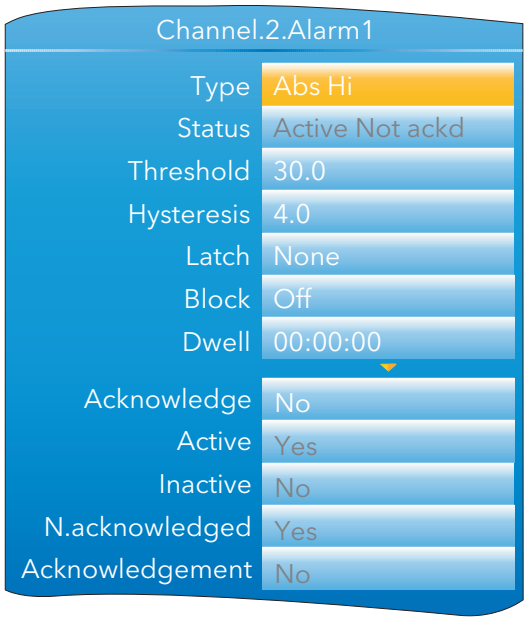


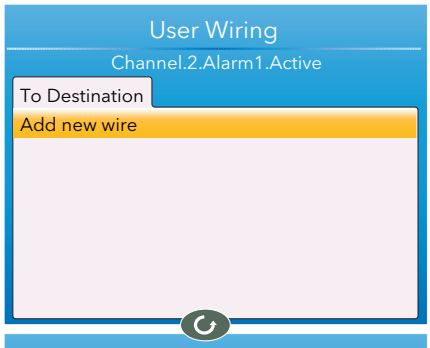
Figure 7.1a Channel 2, Alarm 1 set up

Note: the channel alarm areas of configuration become accessible only once the channel with which they are associated has been configured with a suitable 'Type' (section 4.4.1).

7.1 DRIVE RELAY EXAMPLE (Cont.)

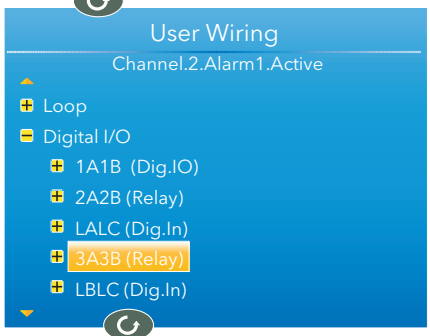
2. Highlight the 'Active' field, and press and hold the scroll button for a few seconds, until the top level User Wiring page appears.
   The name of the selected parameter appears at the top of the page. Any already existing wires from this parameter would appear below the 'Add new wire' area.

3. With 'Add new wire' highlighted operate the Scroll button.



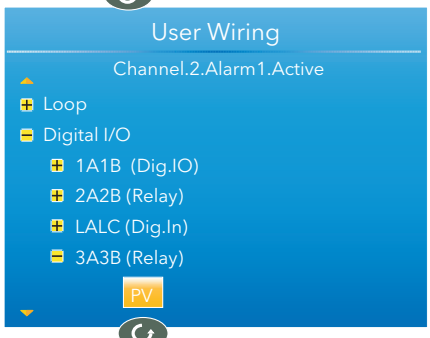
4. Use the down arrow to highlight 'Digital I/O' and press the scroll button.

5. Use the down arrow to highlight '3A3B (Relay)' and press the scroll button.



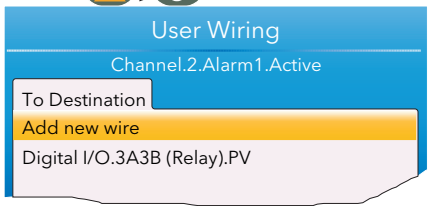
6. Use the down arrow to highlight 'PV' and press the scroll button.

   Note: If this parameter is already wired-to, the 'wired' symbol appears to the left of the parameter.



7. When the confirmation window appears, use the up or down arrow to highlight 'Ok', then operate the scroll button again.

8. The top level user wiring page reappears, showing the destination parameter.



7.1.1 Wire removal

At the top level user wiring page, use the up and down arrow buttons to highlight the wire to be deleted, and operate the scroll key. In the 'Delete Wire' confirmation window, highlight 'Ok' and operate the scroll key again. The wire is deleted without further confirmation.

7.2 COUNTER EXAMPLE

This example shows how to set up a counter to be incremented each time Channel 1 Alarm 1 becomes active, and reset each time channel 2, alarm 1 is acknowledged. For this example, Virtual Channel 3 will be configured as the counter, with a preset value of 0.

1. At Channel.1.Main, set:

   Type = test
   Test Signal = Sine 4 min.
   Scale Low = 0
   Scale High = 100

2. At Channel.1.Alarm1, set:

   Type = Abs Hi
   Threshold = 50
   Latch = None

3. At Channel.2.Main, set:

   Type = Test
   Test Signal = Sine 40 min.
   Scale Low = 0
   Scale High = 100

4. At Channel.2.Alarm 1, set:

   Type = Abs Hi
   Threshold = 90
   Latch = Manual

5. At Virtual Channel.3.Main, set:

   Type = Counter
   Operation = On
   Input = 1

All the other parameters can be left at their defaults.

6. Still at Virtual Channel 3 (Main), use the up/down arrow buttons to highlight 'Trigger'. Press and hold the scroll key. The top level User Wiring page appears, this time with a 'From Source' tab as well as the 'To Destination' tab of example 1. This is because this parameter is read/write, whereas Alarm Active is read only (i.e. its value may be read but not changed).
7. Use the up (or down) arrow button to select the 'From Source' tab.

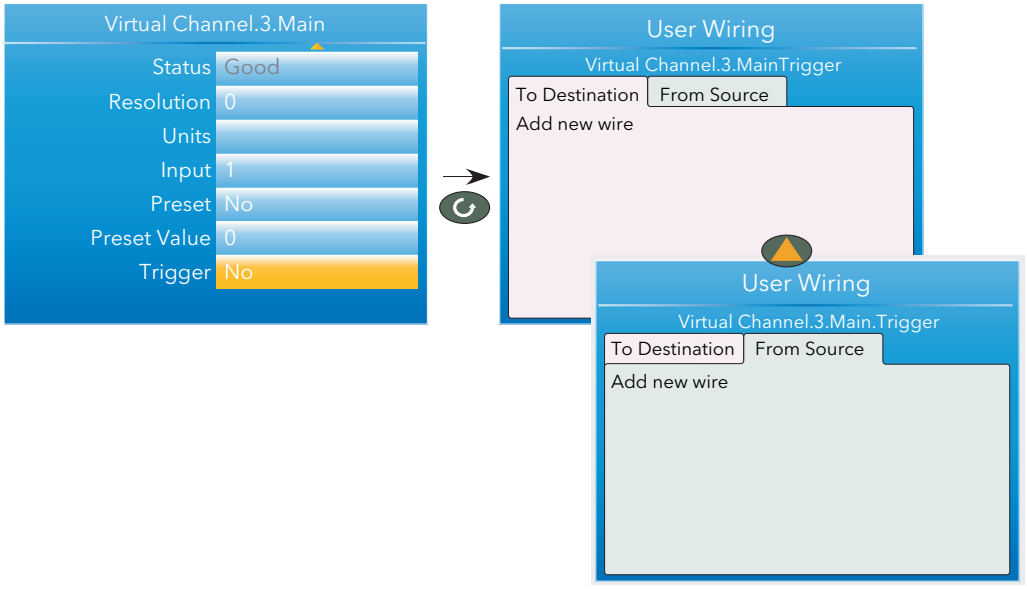


Figure 7.2a Wiring a counter: part 1

7.2 COUNTER EXAMPLE (Cont.)

8. Operate the Scroll key to highlight 'Add new wire', then again to display the top level parameter list.
9. Use the down arrow button to highlight 'Channel' and operate the scroll button.
10. Operate the scroll button to select '1'.
11. Highlight 'Alarm 1' and operate the scroll button.
12. Use the down arrow button to highlight 'Active'. Operate the Scroll button again, and create the new wire.
13. Use the Page button twice to return to the Virtual Channel 3 menu.

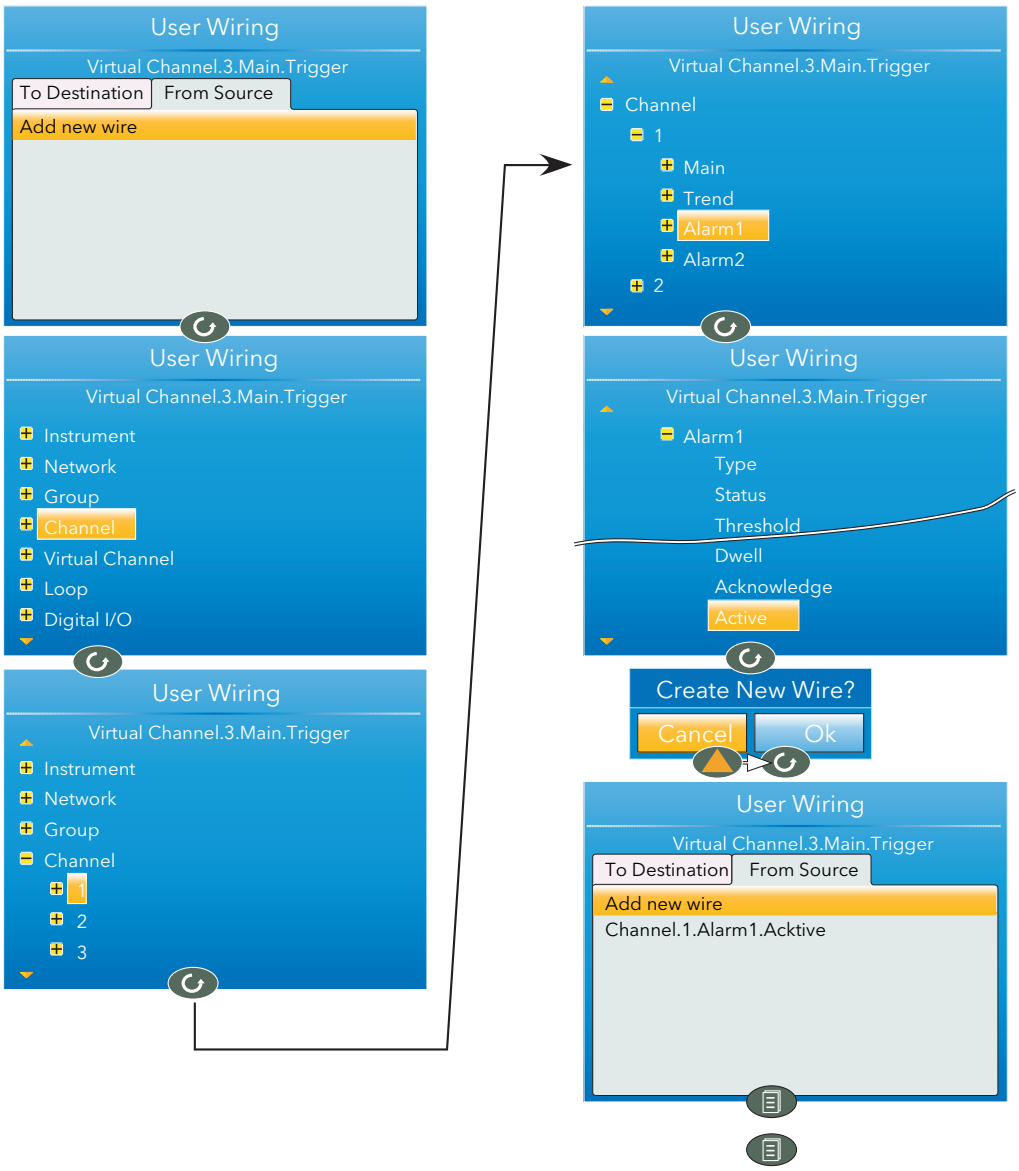


Figure 7.2b Wiring a counter: part 2

7.2 COUNTER EXAMPLE (Cont.)

14. At Virtual Channel.3.Main, use the down arrow to select 'Preset'. Press and hold the scroll key. The top level User Wiring page appears.
15. Use the up (or down) arrow button to select the 'From Source' tab, if not already selected.
16. Operate the Scroll key to highlight 'Add new wire', then again to display the top level parameter list.
17. Use the down arrow button to highlight 'Channel' and operate the scroll button.
18. Use the down arrow button to highlight '2' and operate the scroll button.
19. Highlight 'Alarm 1' and operate the scroll button.
20. Use the down arrow button to highlight 'Acknowledgement' (not 'Acknowledge'). Operate the Scroll button again, and create the new wire.

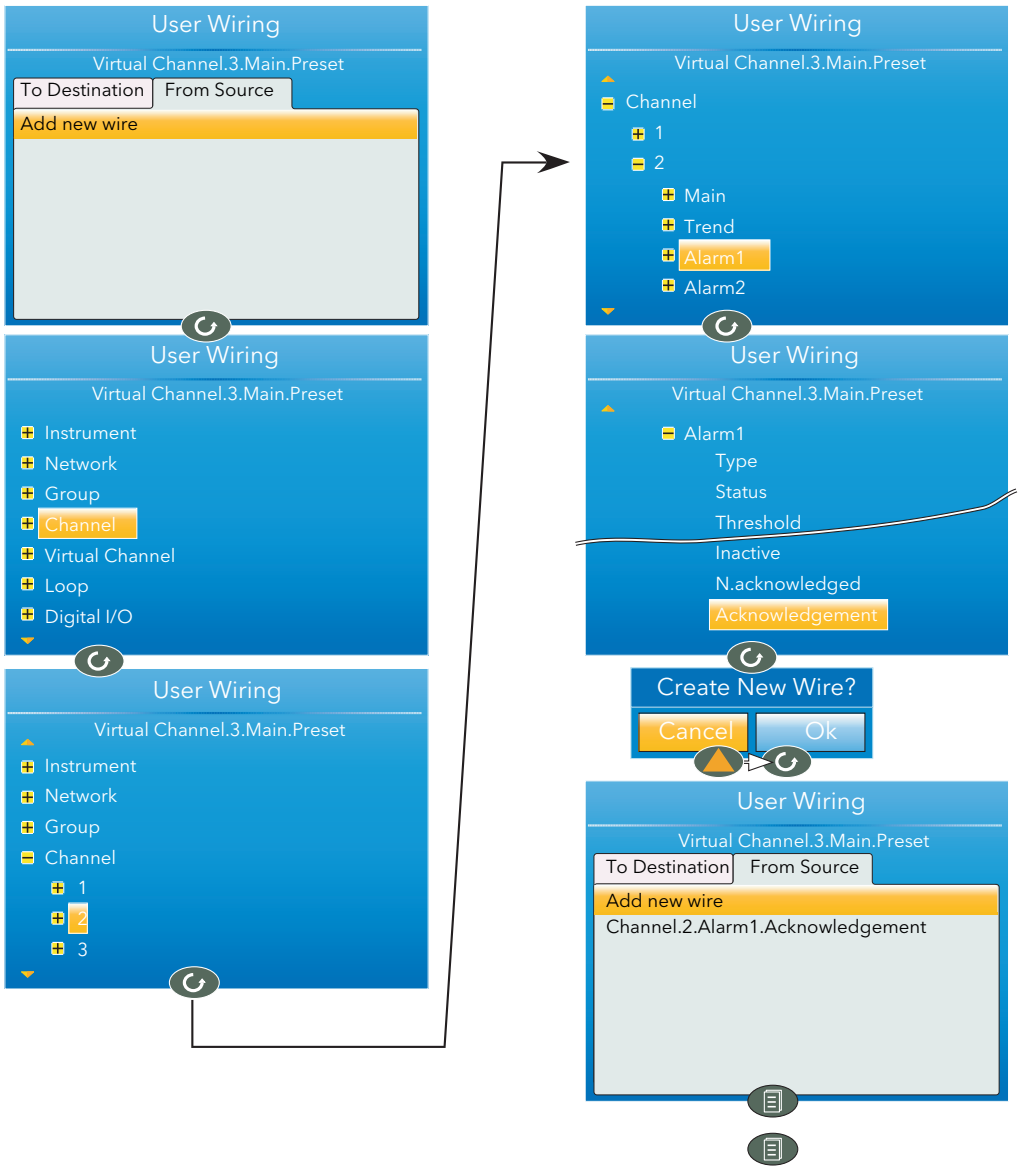


Figure 7.2c Wiring a counter: part 3

Appendix A: TECHNICAL SPECIFICATION

A1 INSTALLATION CATEGORY AND POLLUTION DEGREE

This product has been designed to conform to BS EN61010 installation category II and pollution degree 2, defined as follows:

Installation category II

The rated impulse voltage for equipment on nominal 230V mains is 2500V.

Pollution degree 2

Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

A2 RECORDER SPECIFICATION

I/O types

Analogue i/p	Four
Digital i/o	One
Digital i/p	Two
Relay o/p	Two + two with shared common connection

Features	CSV archive format
	File transfer protocol (FTP)
	Messages
	Modbus TCP slave
	uhh (history file) archiving
	USB port at rear of instrument
	User linearisation tables (four)
	Two control loops (optional)
	Zirconia probe support (optional)
	14 Virtual channels (each configurable as maths, totaliser or counter).

Environmental performance

Ambient temperature range		
	Operating:	0 to 55°C
	Storage:	-20 to +70°C
Humidity range	Operating:	5% to 85% RH non condensing
	storage:	5% to 85% RH non condensing
Protection	Front panel	IP65, NEMA4X (International)
	Behind panel:	IP10 (International)
Shock/Vibration		To BS EN61131-2 (5 to 150 Hz. at 1g; 1 octave per min.)
Altitude		<2000 metres
Atmosphere		Not suitable for use in explosive or corrosive atmospheres.
Electrical safety		BS EN61010-1 (Installation category II; Pollution degree 2)
Electromagnetic compatibility		
	Emissions:	BS EN61326 Limit B - Light industrial.
	Immunity	BS EN61326 Industrial

Other approvals and compliance details

General:	CE and cUL, EN61010
PV input	AMS2750D compliant
RoHS	EU; China
Packaging	BS EN61131-2 section 2.1.3.3.

Physical

Panel mounting	1/4 DIN
Weight	0.44kg (15.52 oz.)
Panel cutout dimension	92 mm x 92 mm (both -0.0 +0.8) or 3.62 in x 3.62 in (both -0.00 +0.03 in) (figure 2.1)
Depth behind panel	90 mm (3.54 in) (figure 2.1) excluding wiring.

Operator interface

Display	3.5" TFT colour display (320 pixels wide x 240 pixels high)
Controls	Four navigation pushbuttons below the display screen (Page, Scroll, Lower and Raise)

Power requirements

Supply voltage	100 to 230Vac ± 15% (48 to 62Hz.)
Power dissipation	9 W
Fuse type	None
Interrupt protection	Holdup >10ms at 85V RMS supply voltage.

Battery backup

Stored data	Time, date, maths, totaliser and counter values.
Support time (for real-time clock)	Minimum of 1 year with unit unpowered.
Replacement period	Three years typical
Type	poly-carbonmonofluoride / lithium (BR2330) (PA260195)

Ethernet communications

Type:	10/100baseT Ethernet (IEEE802.3)
Protocols:	Modbus TCP/IP slave, FTP, DHCP
Cable type	Category 5
Maximum length	100metres (110 yards)
Termination	RJ45. Green LED illuminated = link connected; Amber LED flashing shows link activity.

USB port

Number of ports	One at rear of instrument
Standard	USB1.1
Transmission speeds	1.5Mbits/sec (low speed device)
Maximum current	<100mA
Peripherals supported	Memory stick

A2 RECORDER SPECIFICATION (Cont.)

Update/Archive rates

Sample rate (input/output)	8Hz
Trend update	8 Hz max
Archive sample value	Latest value at archive time
Display value	Latest value at display update time.

A3 ANALOGUE INPUT SPECIFICATION

General

Number of anaologue inputs	Four
Input types	dc Volts, dc mV, dc mA (external shunt required), thermocouple, RTD (2-wire and 3-wire), digital (contact closure)
Input type mix	Freely configurable
Sample rate	8Hz (125ms)
Conversion method	16 bit delta sigma.
Input ranges	See below.
Mains rejection (48 to 62Hz)	
Series mode:	>95dB
Common mode:	>179dB
Common mode voltage	250Vac max.
Series mode voltage	280mV at lowest range; 5V peak-to-peak, at highest range.
Input impedance	See relevant Range specification, below.
Overvoltage protection Continuous:	± 30V RMS
Transient (<1ms):	±200V pk-pk between terminals.
Sensor break detection Type	ac sensor break on each input giving quick response with no associated dc errors.
Recognition time:	<3 secs.
Minimum break resistance:	40mV, 80mV ranges: 5kΩ; other ranges: 12.5kΩ
Shunt (mA inputs only) Values	1Ω to 1kΩ, mounted externally.
additional error due to shunt:	0.1% input
Isolation Channel to channel:	300V RMS or dc (double insulation)
Channel to common electronics:	300V RMS or dc (double insulation)
Channel to ground:	300V RMS or dc (double insulation)
Dielectric strength Test:	BS EN61010, 1 minute type test
Channel to channel:	2500 Vac
Channel to ground:	1500 Vac

DC input ranges

Ranges		40mv, 80mV, 2V; 10V (-4.0 to +10V)
40mV Range	Range:	-40mV to + 40mV
	Resolution	1.9µV (unfiltered)
	Measurement noise:	1.0µV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±4.6µV ±0.053% of measurement at 25°C ambient
	Temperature coefficient:	±0.2µV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ
80mV Range	Range:	-80mV to + 80mV
	Resolution	3.2µV (unfiltered)
	Measurement noise:	3.3µV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±7.5µV ±0.052% of measurement at 25°C ambient
	Temperature coefficient:	±0.2µV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ
2V Range	Range:	±2V
	Resolution	82µV
	Measurement noise:	90µV peak-to-peak with 1.6s input filter
	Linearity error:	0.003% (best fit straight line)
	Calibration error:	±420µV ±0.044% of measurement at 25°C ambient
	Temperature coefficient:	±125µV/°C ± 13ppm/°C of measurement from 25°C ambient
	Input leakage current:	±14nA
	Input resistance:	100MΩ
10V Range	Range:	-3V to +10V
	Resolution	500µV
	Measurement noise:	550µV peak-to-peak with 1.6s input filter
	Linearity error:	0.007% (best fit straight line) for zero source resistance. Add 0.003% for each 10Ω source and lead resistance
	Calibration error:	±1.5mV ±0.063% measurement at 25°C ambient
	Temperature coefficient:	±66µV/°C ± 45ppm/°C of measurement from 25°C ambient
	Input resistance:	62.5kΩ for input voltages > 5.6V. 667kΩ for input ranges < 5.6V.

A3 ANALOGUE INPUT SPECIFICATION (Cont.)

Resistance input ranges

Temperature scale	ITS90
Types, ranges and accuracies	See table
Maximum source current	200µA

Pt100 figures

Range:	0 to 400Ω (-200 to +850°C)
Resolution:	0.05°C
Measurement noise:	0.05°C peak-peak with 1.6s input filter
Linearity error:	0.0033% (best fit straight line)
Calibration error:	±0.31°C ±0.023% of measurement in °C at 25°C ambient
Temperature coefficient:	±0.01°C/°C ±25ppm/°C measurement in °C from 25°C ambient
Lead resistance	0 to 22Ω matched lead resistances
Bulb current:	200µA nominal

RTD type	Overall range °C	Standard	Max. linearisation error
Cu10	-20 to + 400	General electric Co.	0.02°C
Cu53	-70 to + 200	RC21-4-1966	<0.01°C
JPT100	-220 to + 630	JIS C1604:1989	0.01°C
Ni100	-60 to + 250	DIN43760:1987	0.01°C
Ni120	-50 to + 170	DIN43760:1987	0.01°C
Pt100	-200 to + 850	IEC751	0.01°C
Pt100A	-200 to + 600	Eurotherm Recorders SA	0.09°C

Table A3a RTD type details

Thermocouple data

Temperature scale	ITS90
CJC Types:	Off, internal, external, remote.
Remote CJC source	An input or maths channel
Internal CJC error	<1 °C max, with instrument at 25 °C
Internal CJC rejection ratio:	40:1 from 25°C
Upscale/downscale drive	High, low or none independently configurable for each channel's sensor break detection.
Types, ranges and accuracies	See table A3b

T/C type	Overall range (°C)	Standard	Max. linearisation error
B	0 to + 1820	IEC584.1	0 to 400°C = 1.7°C 400 to 1820°C = 0.03°C
C	0 to + 2300	Hoskins	0.12°C
D	0 to + 2495	Hoskins	0.08°C
E	-270 to + 1000	IEC584.1	0.03°C
G2	0 to + 2315	Hoskins	0.07°C
J	-210 to + 1200	IEC584.1	0.02°C
K	-270 to + 1372	IEC584.1	0.04°C
L	-200 to + 900	DIN43710:1985 (to IPTS68)	0.02°C
N	-270 to + 1300	IEC584.1	0.04°C
R	-50 to + 1768	IEC584.1	0.04°C
S	-50 to + 1768	IEC584.1	0.04°C
T	-270 to + 400	IEC584.1	0.02°C
U	-200 to + 600	DIN43710:1985	0.08°C
NiMo/NiCo	-50 to + 1410	ASTM E1751-95	0.06°C
Platinel	0 to + 1370	Engelhard	0.02°C
Mi/NiMo	0 to + 1406	Ipsen	0.14°C
Pt20%Rh/Pt40%/Rh	0 to + 1888	ASTM E1751-95	0.07°C

Table A3b Thermocouple types, ranges and accuracies

A4 RELAY AND LOGIC I/O SPECIFICATION

OP1 and OP2 logic i/o and relay specification.

Active (current on) current sourcing logic output

Voltage output across terminals	+11V min; +13V max.
Short circuit output current	6mA min. (steady state); 44mA max. (switch current)

Inactive I/O1 (current off) current sourcing logic output

Voltage output across terminals	0V (min.); 300mV (max)
Output source leakage curent into short circuit	0µA (min.); 100µA max

Active (current on) I/O1 contact closure sourcing logic input

Input current	Input at 12V:	0mA (min.); 44mA (max.)
	inout at 0V:	6mA min. (steady state); 44mA max. (switch current)
Open circuit input voltage		11V (min.); 13V (max.)
Open circuit (inactve) resistance		500Ω (min.); ∞ (max.)
Closed circuit (active) resistance		0Ω (min.); 150Ω (max.)

Relay contacts

Contact switching power (resistive)	Max: 2A at 230V RMS ±15%; Min: 100mA @ 12V.
Maximum current through terminals	2A

A5 DIGITAL INPUTS

DigInA, DigInB, contact closure logic input

Contact closure

I/O terminal applied voltage range	0V (min.); 25V (max.)
Short circuit sensing current (source)	5.5mA (min.); 6.5mA (max.)
Open circuit (inactive) resistance	600 Ω (min.); ∞ (max.)
Closed circuit (active) resistance	0Ω (min.); 300Ω (max.)
Open circuit (inactive) voltage input	5V (min.); 12V (max.)
Closed circuit (active) voltage input	-2V (min.); +2V (max.)

A6 BLOCKS SUPPORTED

A6.1 FUNCTION BLOCKS

None this software release

A6.2 APPLICATION BLOCKS

Zirconia

This page is deliberately left blank

Appendix B CONTROL LOOPS

Note: See section 4.6 for Loop configuration details

B.1 INTRODUCTION

With this recorder, two control loops are available, each loop containing two outputs (Channel 1 and Channel 2) which can be individually configured for PID, On/Off or valve position. For temperature control, channel 1 is normally configured for heating and channel 2 for cooling.

B1.1 EXAMPLE (HEAT ONLY)

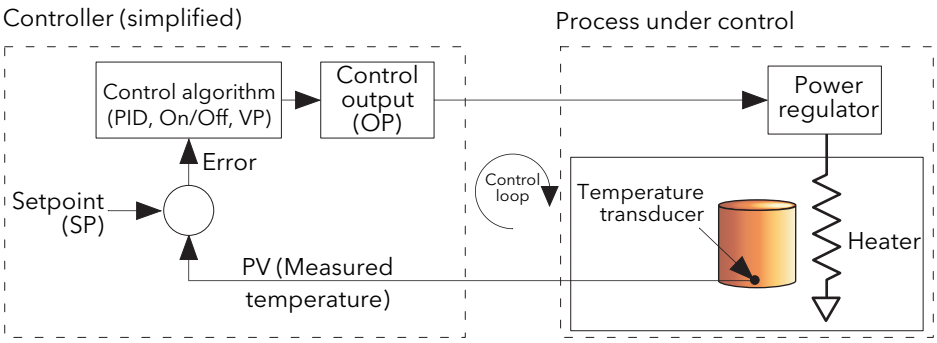


Figure B1.1 Control loop example

The measured temperature (process variable, or 'PV') is connected to the input of the controller, where it is compared with the 'Setpoint' (SP) (the target temperature). If there is a difference between the PV and the SP, the controller calculates and outputs a heating demand. This output is applied to the process heating device, which in turn causes a change in the PV in a direction intended to result in a zero error.

B2 CONTROL LOOP DEFINITIONS

B2.1 AUTO/MANUAL

In manual mode, if 'On/Off' control is configured, the output power may be edited by the user but the only power values allowed are: +100% (heat on; cool off) for positive user entries, 0% (heat off; cool off) for zero entry or -100%. (heat off; cool on) for negative entries.

In manual mode, for 'PID' control the output may be edited between +100% and (if 'cool' is configured), -100%. The actual output value is subject to limiting and output rate limit.

In manual mode, for valve position control, the up and down arrow buttons directly control (nudge) the raise and lower relay outputs respectively. It is also possible to control the valve by sending nudge commands over a serial link, or by software wiring from a suitable parameter. A single nudge command moves the valve by 1 minimum on time; longer nudge demands produce longer valve movements. See section 9 for more details.

If sensor break occurs while the controller is in automatic the controller outputs the sensor break output power. In such a case the user can switch to manual control and edit the output power. On returning to automatic control, the controller checks again for sensor break.

If autotune is enabled while in manual mode, the autotune remains in a reset state such that when the user puts the controller into automatic control the autotune starts.

B2.2 TYPES OF CONTROL LOOP

B2.2.1 On/Off control

This form of control turns heating power on when the process value is below the setpoint, and turns it off when it is above the setpoint (see also figure B2.6.9a). If cooling is configured, it has its own relay which operates in a similar way. In Direct Acting mode, the behaviour is inverted. On/off is suitable for controlling switching devices such as relays.

Because of the thermal inertia of the load, a certain amount of oscillation will take place, and this can affect the quality of the product. For this reason, On/Off control is not recommended for critical applications.

Depending on the nature of the process being controlled, some hysteresis may have to be included to prevent continuous operation or chatter in the controlling device.

B2.2.2 PID Control

Also known as 'three term control', this type of control continuously adjusts the output demand, according to a set of rules, in order to control the process as closely as possible to requirements. PID provides more stable control than On/Off control but is more complex to set up as the parameters must match the characteristics of the process under control.

The three major parameters are: Proportional band (PB), Integral time (Ti) and Derivative time (Td) and the output from the controller is the sum of these three terms. This output is a function of the size and duration of the error value and the rate-of-change of the process value.

It is possible to disable the integral and/or derivative terms and control on proportional only, on proportional plus integral (PI) or proportional plus derivative (PD).

PI control is often used when the PV is noisy and/or subject to rapid variations, where derivative action would cause the output power to fluctuate wildly.

PROPORTIONAL BAND

The proportional band (PB) delivers an output which is proportional to the size of the error signal. It is the range over which the output power is continuously adjustable in a linear fashion from 0% to 100% (for a heat only controller). Below the proportional band the output is full on (100%), above the proportional band the output is full off (0%) as shown in figure B2.2.2a.

The width of the proportional band determines the magnitude of the response to the error. If PB is too narrow (high gain) the system oscillates; if it is too wide (low gain) control is sluggish. The ideal situation is when the proportional band is as narrow as possible without causing oscillation.

Figure B2.2.2a also shows the effect of narrowing proportional band to the point of oscillation. A wide proportional band results in straight line control but with an appreciable initial error between setpoint and actual temperature. As the band is narrowed the temperature gets closer to setpoint until eventually, it becomes unstable.

The proportional band may be set in engineering units or as a percentage of the controller range.

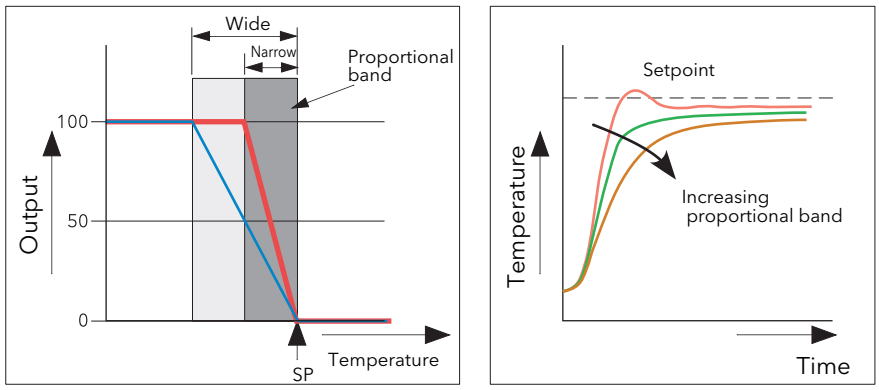


Figure B2.2.2a Proportional band action (reverse acting)

B2.2 TYPES OF CONTROL LOOP (Cont.)

INTEGRAL TERM

In a proportional only controller, as seen in the previous section, an error must exist between setpoint and PV in order for the controller to deliver power. Integral is used to achieve zero steady state control error.

The integral term slowly modifies the output level as a result of any error between setpoint and measured value. If the measured value is below setpoint the integral action gradually increases the output in an attempt to correct the error. If it is above setpoint integral action gradually decreases the output or increases the cooling power to correct the error.

Figure B2.2.2b shows proportional plus integral action.

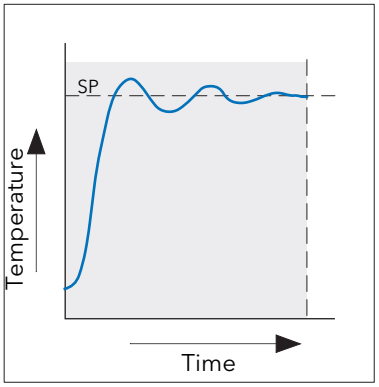


Figure B2.2.2b: Proportional + Integral Control

The integral term is set in seconds. The longer the integral time constant, the more slowly the output is modified and the more sluggish the response. Too small an integral time causes the process to overshoot, and perhaps to start oscillating. The integral action may be disabled by setting its value to Off.

DERIVATIVE TERM

Derivative (or rate) action provides a sudden change in output linked to the rate of change in error, whether this is caused by PV alone (derivative on PV) or by a change in the SP as well (derivative on error selection). If the measured value falls quickly, derivative provides a large change in output in an attempt to correct the perturbation before it goes too far. It is most beneficial in recovering from small perturbations.

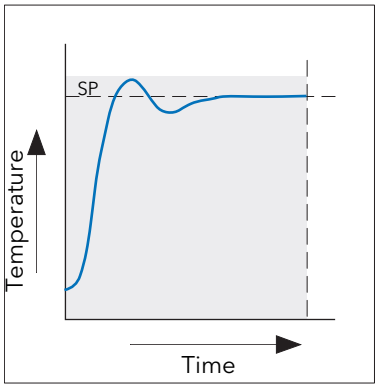


Figure B2.2.2c Proportional + Integral + Derivative Action

Derivative is used to improve the performance of the loop. There are, however, situations where derivative may be the cause of instability. For example, if the PV is noisy, then derivative can amplify that noise and cause excessive output changes, in these situations it is often better to disable the derivative and re-tune the loop.

B2.2 TYPES OF CONTROL LOOP (Cont.)

Derivative should not be used to curb overshoot in situations when the output is saturated at Op High or Op Low for extended periods, such as process start up, since to do so degrades the steady state performance of the system. Overshoot inhibition is best left to the approach control parameters, High and Low Cutback.

If Derivative is set to Off, no derivative action will be applied.

Derivative can be calculated on change of PV or change of Error. If configured on error, then changes in the setpoint will be transmitted to the output. For applications such as furnace temperature control, it is common practice to select Derivative on PV to prevent thermal shock caused by a sudden change of output as a result of a change in setpoint.

B2.2.3 Motorised valve control

Designed specifically for driving motorised valves this type of control can operate in 'Unbounded' mode (VPU) or 'Bounded' mode (VPB). Relay outputs are used to drive the valve motor.

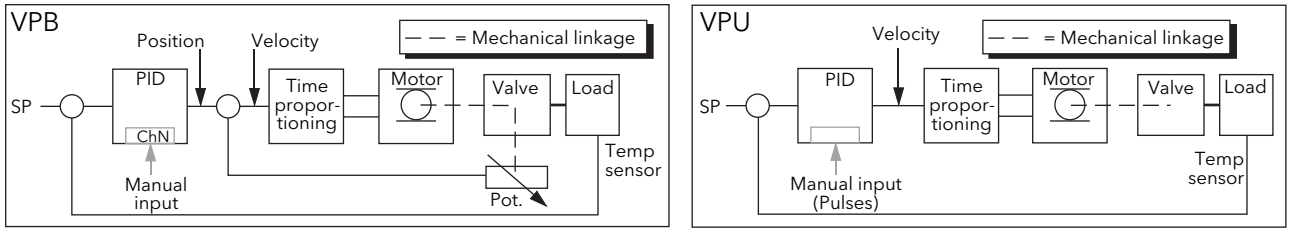


Figure B2.2.3 VPB and VPU comparison

Unbounded valve positioning (VPU) does not require a position feedback potentiometer in order to operate because it controls directly the direction and velocity of the movement of the valve in order to minimise the error between the setpoint (SP) and the process variable (PV). Control is performed by delivering a 'raise' or 'lower' pulse to control the velocity of the valve in response to the control demand signal.

Bounded VP (VPB) control uses PID (or any other combination of the three terms) to set a required valve position. A feedback potentiometer linked to the valve provides a signal giving actual valve position. This allows the control loop to calculate the difference between required and actual position dynamically, and adjust control output accordingly. Control is performed by delivering a 'raise' or 'lower' pulse to adjust the valve position.

MANUAL MODE

Bounded VP controls in manual mode because the inner positional loop is still running against the potentiometer feedback, so it is operating as a position loop.

In boundless mode the algorithm is a velocity mode positioner. When manual is selected then the up and down arrow produce +100% or –100% velocity respectively for the duration of the key press.

In boundless mode it is essential that the motor travel time is set accurately in order to allow the integral time to calculate correctly. Motor travel time is defined as (valve fully open – valve fully closed). This is not necessarily the time printed on the motor since, if mechanical stops have been set on the motor, the travel time of the valve may be different.

Every time the valve is driven to its end stops the algorithm is reset to 0% or 100% to compensate for any changes which may occur due to wear in linkages or other mechanical parts.

This technique makes boundless VP look like a positional loop in manual even though it is not. This enables combinations of heating and cooling e.g. PID heat, VPU cool with manual mode working as expected.

MOTORISED VALVE OUTPUT CONNECTIONS

The loop output which has been configured as valve position can be wired to the PV input of one of the pairs of relays 2A2B/3A3B or 4AC/5AC which has been configured as Type = 'Valve Raise'. Only one relay input needs to be wired as the other relay of the pair will be automatically set to 'Valve Lower'. For example, if Loop 1 Channel 1 output is wired to Relay 2A2B and the 'Type' is configured as 'Valve Raise' then the Type for Relay 3A3B will be 'Valve Lower'.

B2.3 LOOP PARAMETERS

B2.3.1 Relative cool gain (R2G)

This is the gain of channel 2 control output, relative to the channel 1 control output and is used to compensate for the different quantities of power available to heat and to cool a process. For example, water cooling applications might require a relative cool gain of 0.25 because cooling is 4 times greater than the heating process at the operating temperature.

By default, this parameter is set automatically when an Autotune is performed, but setting the Tune menu parameter 'AT.R2G' to 'No' causes the R2G value(s) entered in the PID menu to be used instead.

B2.3.2 High and Low cutback

Cutback high 'CBH' and Cutback low 'CBL' are values that modify the amount of overshoot, or undershoot, that occurs during large step changes in PV under start-up conditions, for example. They are independent of the PID terms which means that the PID terms can be set for optimal steady state response and the cutback parameters used to modify any overshoot which may be present.

Cutback involves moving the proportional band towards the cutback point nearest the measured value whenever the latter is outside the proportional band and the power is saturated (at 0 or 100% for a heat only controller). The proportional band moves downscale to the lower cutback point and waits for the measured value to enter it. It then escorts the measured value with full PID control to the setpoint. In some cases it can cause a 'dip' in the measured value as it approaches setpoint as shown in figure B2.3.2 but generally decreases the time to needed to bring the process into operation.

The action described above is reversed for falling temperature.

If cutback is set to Auto the cutback values are automatically configured to 3 × PB.

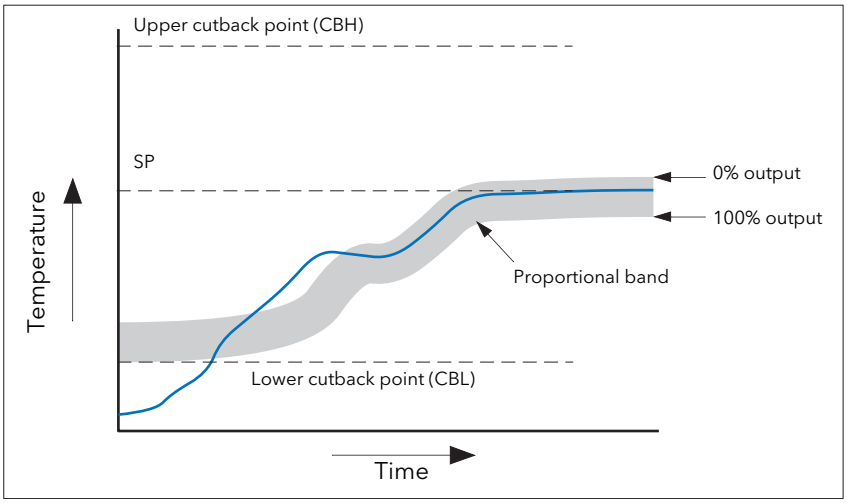


Figure B2.3.2 Cutback operation

Briefly, if PV < CBL then the output is set to its maximum.

If PV > CBH, then the output is set to its minimum

If PV lies within the range CBH-CBL, then PID calculations take control.

B2.3.3 Manual Reset

With PID control, the integral term automatically removes the steady state error from the setpoint. With PD control, the integral term is set to 'OFF', and the measured value will not settle precisely at the setpoint. The Manual Reset parameter (MR in the PID menu) represents the value of the power output that will be delivered when the error is zero. This value must be set manually in order to remove the steady state error.

B2.3 LOOP PARAMETERS (Cont.)

B2.3.4 Integral Hold

If 'Integral Hold' (Main menu) is set to 'Yes', the integral component of the PID calculation is frozen, that is, it holds its current value but does not integrate any disturbances in the plant. This is equivalent to switching into PD control with a manual reset value preconfigured.

Integral Hold may be used, in a situation where the loop is expected to open. For example, it may be necessary to turn heaters off for a short period or to switch into manual at low power. In this case it may be advantageous to wire Integral Hold to a digital input which activates when the heaters are turned off. When the heaters are switched on again, because the integral is at its previous value, overshoot is minimised.

B2.3.5 Integral De-bump

This feature is not accessible to the user. When changing from Manual to Auto control. the integral component is forced to: (out put value – proportional component – derivative component) (I = OP – P – D).

This ensures that no change occurs in output at the point of switch over, ('Bumpless Transfer**').** The output power then gradually changes in accordance with the demand from the PID algorithm.

If manual mode = 'Track', bumpless transfer also occurs when changing from Auto to Manual control. At the point of changeover the output power remains the same as the demand in the auto state. The value can then be altered by the operator. For other modes, the output steps to the 'Forced output' or 'Last MOP' value as appropriate. See 'Manual Mode in the Output menu for further details

B2.3.6 Loop Break

Loop Break attempts to detect loss of restoring action in the control loop by checking the control output, the process value and its rate of change. Since response times vary from process to process, the Loop Break Time (LBT) parameter (PID menu) allows a time to be set before a Loop Break Alarm (Loop Break - Diagnostics menu) becomes active. LBT is set automatically in Autotune.

The Loop Break Alarm parameter has no direct effect on control. In order to define behaviour under Loop Break conditions, the parameter must be wired, for example, to a relay, which can then activate an external indicator.

It is assumed that, so long as the requested output power is within the output power limits of a control loop, the loop is operating in linear control and is therefore not in a loop break condition. If, however, the output becomes saturated then the loop is operating outside its linear control region. If the output remains saturated at the same output power for a significant duration, then this might be symptomatic of a fault in the control loop. The source of the loop break is not important, but the loss of control could be catastrophic.

Since the worst case time constant for a given load is usually known, a worst case time can be calculated over which the load should have responded with a minimum movement in temperature. By performing this calculation the corresponding rate of approach towards setpoint can be used to determine if the loop can no longer control at the chosen setpoint. If the PV was drifting away from the setpoint or approaching the setpoint at a rate less than that calculated, the loop break condition would be met.

If an autotune is performed the loop break time is automatically set to Ti × 2 for a PI or PID loop, or to 12 × Td for a PD loop. For an On/Off controller loop break detection is based on loop range settings as 0.1 × Span where Span = Range High – Range Low. Therefore, if the output is at limit and the PV has not moved by 0.1Span in the loop break time a loop break will occur.

If the loop break time is 0 (off) the loop break time can be set manually. Then, if the output is in saturation and the PV has not moved by >0.5 × Pb in the loop break time, a loop break condition is considered to have occurred.

B2.3.7 Gain Scheduling

In some processes the tuned PID set may be different at low temperatures from that at high temperatures particularly in control systems where the response to the cooling power is significantly different from that of the heating power, or when changes in the process have occurred. Gain scheduling allows a number of PID sets to be stored and provides automatic transfer of control between one set of PID values and another. For this instrument, the maximum number of sets is three which means that two boundaries are provided to select when the next PID set is used. When a boundary is exceeded the next PID set is selected bumplessly. Hysteresis is used to stop scheduling oscillation at the boundaries.

Gain scheduling is basically a look up table which can be selected using different strategies or types. Auto tune tunes to the active scheduled PID set.

The following Gain Scheduled types are offered using the PID menu parameter 'Sched Type':

Set	Required set selected by the user. Alternatively soft wiring may be used to control the PID set selection
Setpoint	Transfer between sets is dependent on the setpoint value
PV	Transfer between sets is dependent on the process value
Error	Transfer between sets is dependent on the Error value
Output	Transfer between sets is dependent on the output demand value
Remote	A remote parameter may be wired into the scheduler. The PID set is then selected according to the value of this input.

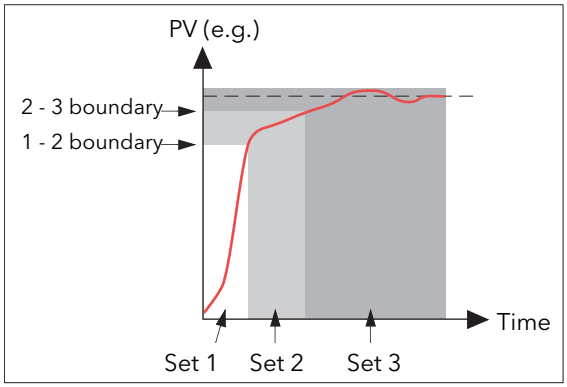


Figure B2.3.7 gain scheduling

B2.4 TUNING

B2.4.1 Introduction

The balancing of the P, I and D terms varies from process to process. In a plastics extruder, for example, there are different responses to a die, casting roll, drive loop, thickness control loop or pressure loop. In order to achieve the best performance from an extrusion line all loop tuning parameters must be set to their optimum values.

Tuning involves setting the following PID menu parameters:

Proportional Band (PB), Integral Time (Ti), Derivative Time (Td), Cutback High (CBH), Cutback Low (CBL), and Relative Cool Gain (R2G - applicable to heat/cool systems only).

The recorder/controller is shipped with these parameters set to default values. In many cases the default values give adequate, stable, straight-line control, but the response of the loop may not be ideal. Because process characteristics vary it is often necessary to adjust the control parameters to achieve best control. To determine the optimum values for any particular loop or process it is necessary to carry out a procedure called loop tuning. If significant changes are later made to the process which affect the way in which it responds it may be necessary to retune the loop.

Users have the choice of tuning the loop automatically or manually. Both procedures require the loop to oscillate and both are described in the following sections.

B2.4.2 Loop Response

Ignoring loop oscillation, there are three categories of loop performance *viz* Under damped, Critically damped and Over damped:

UNDER DAMPED

In this situation the parameters are set to prevent oscillation but lead to an overshoot of the Process Value (PV) followed by decaying oscillation until the PV finally settles at the Setpoint. This type of response can give a minimum time to Setpoint but overshoot may cause problems in certain situations and the loop may be sensitive to sudden changes in PV, resulting in further decaying oscillations before settling once again.

CRITICALLY DAMPED

This represents an ideal situation where noticeable overshoot to small step changes does not occur and the process responds to changes in a controlled, non oscillatory manner.

OVER DAMPED

In this situation the loop responds in a controlled but sluggish manner which results in a non-ideal and unnecessarily slow loop performance.

B2.4.3 Initial Settings

In addition to the tuning parameters listed above, there are a number of other parameters which can affect loop response. These parameters must be correctly configured before tuning is initiated. Parameters include, but are not limited to:-

SETPOINT

Before tuning, the loop conditions should be set as closely as practicable to the actual conditions which will be met in normal operation. For example, in a furnace or oven application a representative load should be included, an extruder should be running, etc.

OUTPUT HIGH, OUTPUT LOW

These Output menu heat and cool limits define the overall maximum and minimum power which may be delivered to the process by the control loop. For a heat only controller the default values are 0 and 100%. For a heat/cool controller the defaults are -100 and 100%. Although most processes are designed to work between these limits there may be instances where it is desirable to limit the power delivered to the process.

REM. OUTPUT LOW, REM. OUTPUT HIGH

If these Remote Output Limits parameters (Output menu) are used, they are effective only if they lie within the Heat/Cool Limits above.

CH2 DEADBAND

Heat/Cool Dead band If a second (cool) channel is configured, a parameter 'Ch2 Deadband' is also available in the Output menu which sets the distance between the heat and cool proportional bands. The default value is 0% which means that heating will cease to be available at the same time as cooling becomes available. The dead band may be set to ensure that there is no possibility of the heat and cool channels operating together, particularly when cycling output stages are installed.

MINIMUM ON TIME

If either or both of the output channels is fitted with a relay or logic output, the parameter 'Min On Time' appears in the output menu. This is the cycling time for a time proportioning output and should be set correctly before tuning is started.

FILTER

The 'Filter' parameter is found in the Channel 'Main' menu (section 4.4). It is used to remove noise from slowly changing signals so that the underlying trend can be seen more clearly.

B2.4.3 INITIAL SETTINGS (Cont.)

RATE

Sets the maximum PID rate-of-change. The output rate limit is active during tuning and can affect the tuning results. Rate is useful in preventing rapid changes in output from damaging the process or heater elements. The parameter 'Rate' is found in the 'Setpoint' menu.

CH1 TRAVEL TIME, CH2 TRAVEL TIME

Valve Travel Time. If the output is a motor valve positioner the 'Ch1 Travel Time' and Ch2 Travel Time' Output menu parameters must be set correctly. The valve travel time is the time taken for the valve to travel from 0% (closed) to 100% (open). This may be different from the motor travel time limits because the mechanical linkage between the motor and the valve, setting of limit switches etc. can modify behaviour. In a valve positioner application, the channel output is wired to the 'PV' input of relay 2A2B or 4AC. Configuring this relay as Type = Valve Raise causes the associated relay (3A3C or 5AC respectively) to be configured automatically as Type = Valve Lower, and the action of the relay pair is controlled by the single wire. In a heat/cool application, channel one is the heat valve and channel two is the cool valve.

B2.4.4 Other tuning considerations

If a process includes adjacent interactive zones, each zone should be tuned independently with the adjacent zones at operating temperature.

It is recommended that a tuning process be initiated when the PV and setpoint are far apart. This allows start up conditions to be measured and cutback values to be calculated more accurately. Cutback is not set for 'Tune at setpoint'.

In a programmer/controller tuning should only be attempted during dwell periods and not during ramp stages. If a programmer/controller is tuned automatically the controller should be placed in 'Hold' during each dwell period whilst autotune is active.

> Note: Tuning, carried out in dwell periods which are at different extremes of temperature may give different results owing to non linearity of heating (or cooling). This may provide a convenient way to establish values for Gain Scheduling.

If an auto tune is initiated there are two further parameters (High Output' and 'Low Output') which need to be set. These are found in the 'Tune' menu.

High Output	Sets a high output limit to be imposed during autotune. Must be ≤ Output High, set in the Output menu.
Low Output	Sets a low output limit to be imposed during autotune. Must be ≥ Output Low, set in the Output menu.

The above values must be set correctly, otherwise sufficient power to achieve SP might not be available during tuning, and the tune will eventually fail.

B2.4.5 Autotune

Autotune automatically sets the following PID menu parameters:

PB	Proportional band.
Ti	Integral time. If previously set to 'Off' Ti will remain off after an autotune.
Td	Derivative time. If previously set to 'Off' Td will remain off after an autotune.
CBH, CBL	Cutback high and low values. If either is set to 'Auto', it will remain so after auto tuning. In order that Autotune set the cutback values for the user, a value other than 'Auto' must be selected before Autotune is initiated. Autotune never returns cutback values less than 1.6 × PB
R2G	Calculated only if the unit is configured as Heat/Cool. Following an Autotune, R2G lies between 0.1 and 10. If the calculated value lies outside this range, a 'Tune Fail' alarm is set.
LBT	Loop break time. Following an autotune, LBT is set to 2 × Ti (if Ti was not previously set 'Off'), or to 12 × Td (if Ti was previously set to 'Off').

B2.4.5 AUTOTUNE (Cont.)

Autotune can be performed at any time, but normally it is performed only once, during the initial commissioning of the process. However, if the process under control subsequently becomes unsatisfactory (because its characteristics have changed), it may be necessary to tune again for the new conditions.

The auto tune algorithm reacts in different ways depending on the initial conditions of the plant. The explanations given later in this section are for the following example conditions:-

1. Initial PV is below the setpoint and, therefore, approaches the setpoint from below for a heat/cool control loop
2. As above, but for a heat only control loop
3. Initial PV is at the same value as the setpoint (tune at setpoint). That is, within 0.3% of the range of the controller if 'PB Units' (Setup menu) is set to 'Percent', or ±1 engineering unit (1 in 1000) if the 'PB Units' is set to 'Eng'. Range is defined as 'Range High' – 'Range Low' for process inputs or the thermocouple or RTD range defined in section A3 for temperature inputs. If the PV is just outside the range stated above the autotune will attempt a tune from above or below SP.

AUTOTUNE AND SENSOR BREAK

When the controller is autotuning and sensor break occurs, the autotune aborts and the controller outputs the sensor break output power 'Sbrk OP' set up in the Output menu. Autotune must be re-started when the sensor break condition is no longer present.

AUTOTUNE AND INHIBIT

If the controller is in autotune when 'Inhibit' is asserted, the tune goes to the Off state (Stage = Reset). On inhibit being released the controller will re-start autotune.

AUTOTUNE AND GAIN SCHEDULING

When gain scheduling is enabled and an autotune is performed, the calculated PID values are written into the PID set that is active, on completion of the tune. Therefore, the user may tune within the boundaries of a set and the values will be written into the appropriate PID set. However, if the boundaries are close (because the range of the loop is not large), then, at the completion of the tune, it cannot be guaranteed that the PID values will be written to the correct set particularly if the schedule type is PV or OP. In this situation the scheduler ('Sched Type') should be switched to 'Set' and the 'active set' chosen manually.

INITIAL CONDITIONS

Configure the parameters described in sections B2.4.3 and B2.4.4, above.

Notes:

1. The 'tighter' power limit applies. For example, if 'High Output' is set to 80% and 'Output High' is set to 70% then the output power will be limited to 70%
2. The PV must oscillate to some degree to allow the tuner to calculate the relevant values. The limits must be set so as to allow oscillation about the setpoint.

INITIATING THE AUTOTUNE

In the Loop Tune menu for the relevant loop, set 'TuneEn' to 'On'.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 1: AUTOTUNE FROM BELOW SP (HEAT/COOL)

The point at which Automatic tuning is performed (Tune Control Point) lies just below the setpoint at which the process is normally expected to operate (Target Setpoint). This ensures that the process is not significantly overheated or overcooled. The Tune Control Point is calculated as follows:-

Tune Control Point = Initial PV + 0.75(Target Setpoint – Initial PV).

The Initial PV is the PV measured after a 1 minute settling period (point 'B' in the figure below).

Examples:

If Target Setpoint = 500°C and Initial PV = 20°C, then the Tune Control Point is 380°C.

If Target Setpoint = 500°C and Initial PV = 400°C, then the Tune Control Point is 475°C.

This is because the overshoot is likely to be less as the process temperature approaches the target setpoint.

Figure B2.4.5a shows the auto tune sequence.

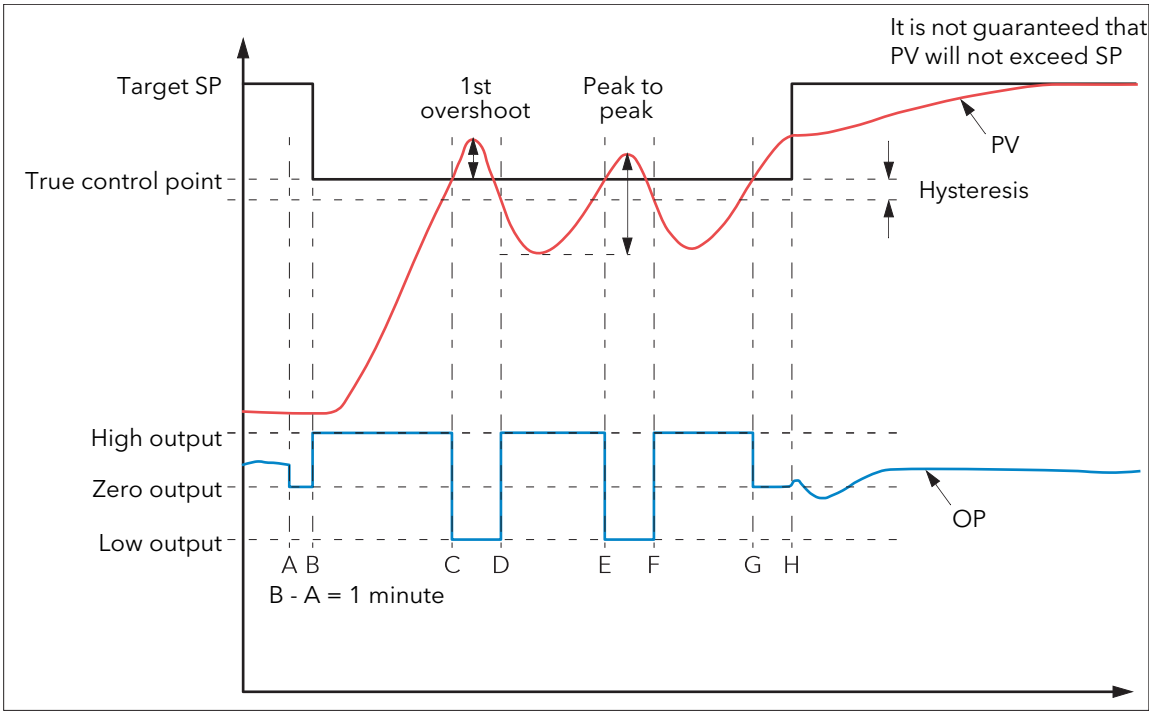


Figure B2.4.5a Autotune heat/cool process

KEY

A	Start of Autotune
A to B	Heating and Cooling off for one minute allows steady state conditions to be established.
B to D	First heat/cool cycle to establish first overshoot. Cutback low (CBL) value calculated from the overshoot magnitude (unless CBL set to 'Auto').
B to F	Two cycles of oscillation allow peak-to-peak value and oscillation period to be determined. PID terms are calculated.
F	Heating is switched on.
G	Heating (and cooling) are switched off allowing the plant to respond naturally. Measurements over the period F to G are used to calculate the Relative Cool Gain (R2G). Cutback High is calculated from the equation (CBH = CBL × R2G).
H	Autotune is turned off and the process is allowed to control at the target setpoint using the new control terms.

Note: Controlling from above SP is identical except that heating and cooling are reversed.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 2: AUTOTUNE FROM BELOW SP (HEAT ONLY)

The sequence of operation for a heat only loop is the same as that described above for a heat/cool loop, except that the sequence ends at 'F' since there is no need to calculate 'R2G' (R2G is set to 1.0 for heat only processes). At 'F' autotune is turned off and the process is allowed to control using the new control terms.

For a tune from below setpoint 'CBL' is calculated on the basis of the size of the overshoot (assuming it was not set to Auto in the initial conditions). CBH is then set to the same value as CBL.

Note: Autotune can also occur when the initial PV is above SP. The sequence is the same as tuning from below setpoint except that the sequence starts with natural cooling applied at 'B' after the first one minute settling time. In this case CBH is calculated and CBL is then set to the same value as CBH.

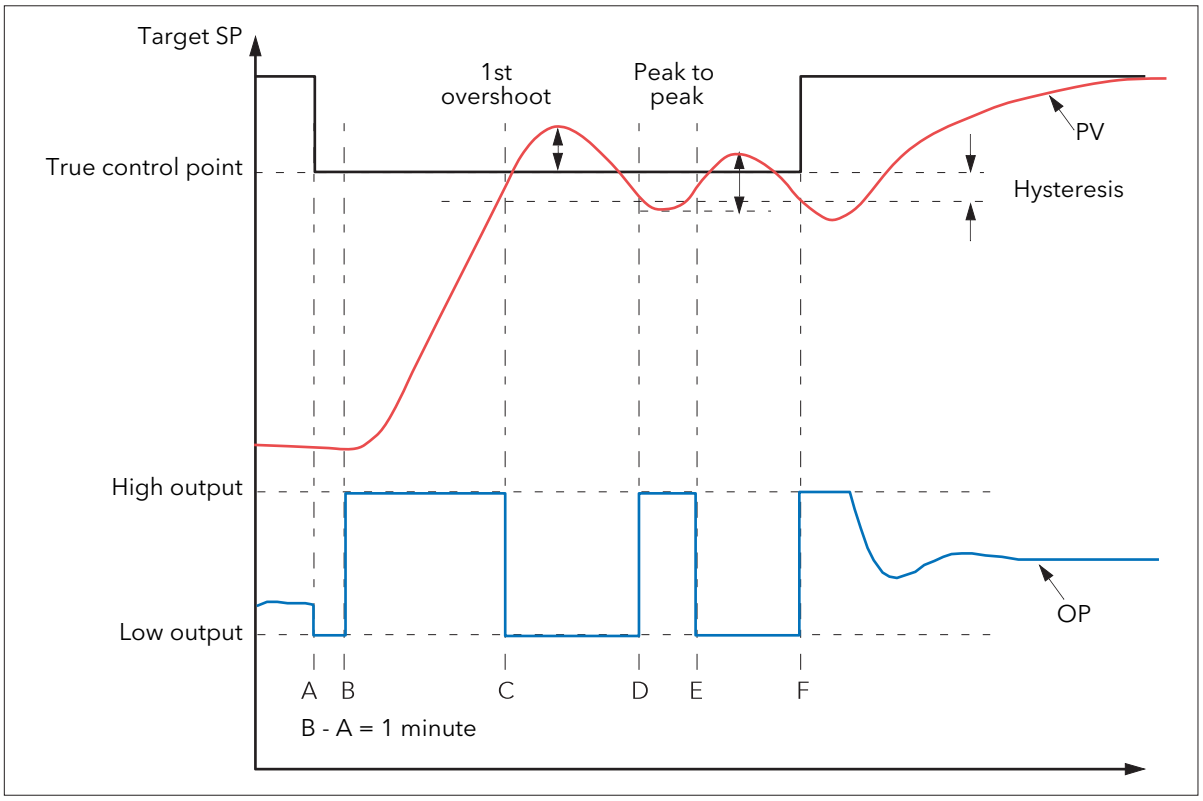


Figure B2.4.5b Autotune heat only process (from below SP)

A	Start of Autotune
A to B	Heating off for one minute to allow steady state conditions to be established.
B to D	First heat cycle to establish first overshoot. Cutback low (CBL) value calculated from the overshoot magnitude (unless CBL set to 'Auto').
D to F	Calculate PID terms.
F	Autotune is turned off and the process is allowed to control at the target setpoint using the new control terms.

B2.4.5 AUTOTUNE (Cont.)

EXAMPLE 3: AUTOTUNE AT SP (HEAT /COOL)

It is sometimes necessary to tune at the actual setpoint being used as shown below.

For a tune at setpoint, autotune does not calculate cutback since there was no initial start up response to the application of heating or cooling. Cutback values of less than 1.6 × PB will not be returned.

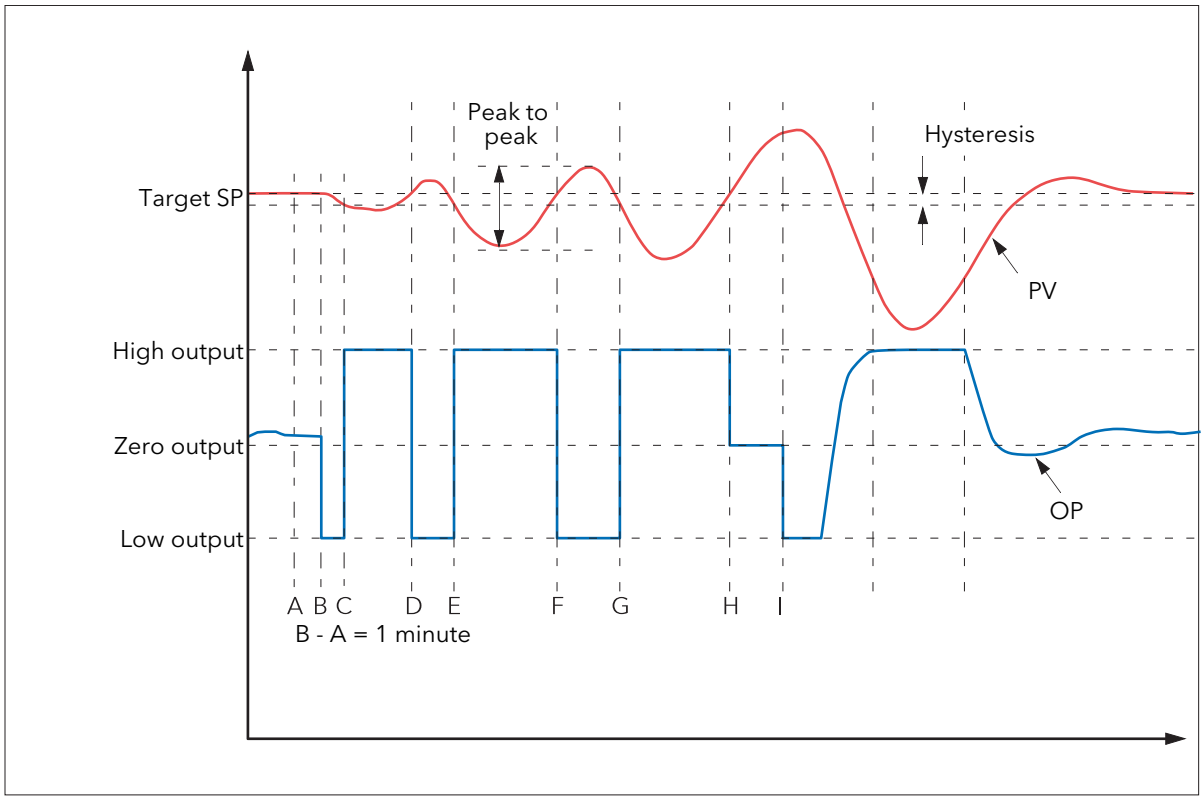


Figure B2.4.5c Autotune at setpoint

A	Start of Autotune. A test is done at the start of autotune to establish conditions for a tune at setpoint. Conditions are that SP must remain within 0.3% of the range of the controller if 'PB Units' (Setup menu) is set to 'Percent', or ±1 engineering unit (1 in 1000) if the 'PB Units' is set to 'Eng'. Range is defined as 'Range High' – 'Range Low' for process inputs or the thermocouple or RTD range defined in section A3 for temperature inputs.
A to B	The output is frozen at he current value for one minute, and the conditions are continuously monitored during this period. If the conditions specified above are met, then an autotune at setpoint is initiated at 'B'. If PV drifts outside the condition limits at any time during this period, tuning at SP is abandoned, and tuning resumes as a 'tune from above' or 'tune from below', depending on the direction of drift. Since the loop is already at setpoint, a Tune Control setpoint is not calculated; the loop is forced to oscillate about the Target SP.
C to G	The process is forced to oscillate by switching the output between the output limits. The oscillation period and the peak-to-peak response are determined, and the PID terms calculated.
G to H	An extra heating stage is initiated, then all heating and cooling are switched off at H, allowing the plant to respond naturally. The relative cool gain (R2G) is calculated.
I	Autotune is switched off and the process is allowed to control at the target setpoint using the newly calculated terms.

B2.4.5 AUTOTUNE (Cont.)

AT.R2G

Some load types and process conditions can cause autotune to set an incorrect value for R2G resulting in an instability in the system after an autotune has completed, In such circumstances, the value of R2G should be checked, and if it is low (approaching 0.1) a manual entry should be made as follows:

1. In the Tune menu, set the AT.R2G parameter to 'No'.
2. In the PID menu, enter the new R2G value (calculated as described below)
3. In the Tune menu, enter a value for Low Output, calculated from: Low Output = -High Output x R2G
4. In the Tune menu, set 'TuneEn' On.

R2G CALCULATION

1. In the Main menu, set the controller to Manual mode
2. Turn heating on (limited by the value of 'Output High' in the Output menu) and measure the heating rate ('H' °C/minute).
3. Allow the process to heat to, say, 10% above the setpoint value then turn the heating off and allow the temperature to settle.
4. Turn cooling power on (limited by the value of 'Output Low' in the Output menu) and measure the cooling rate ('C' °C/minute) whilst allowing the temperature to fall below the setpoint value.
5. Calculate the value of R2G from the equation R2G = (H/C) x (Output Low/output High)

Example:

For a measured heating rate (H) of 10°C per min and a measured cooling rate (C) of 25° per minute and with, Output High = 80% and Output Low = 40%, then R2G = (10/25) x (40/80) = 0.4 x 0.5 = 0.2.

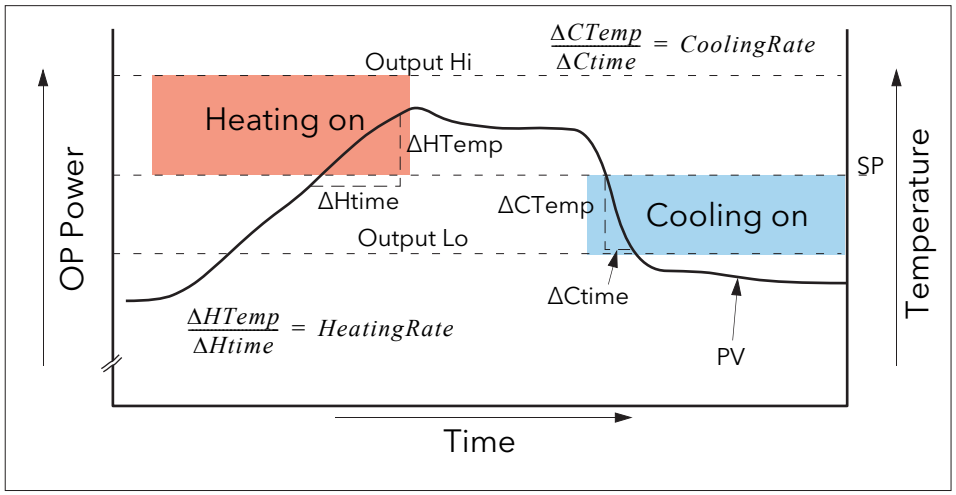


Figure 2.4.5d R2G calculation

Note: This is not a very accurate method as it does not take natural cooling into account. Its main advantage is that it is simple to achieve.

B2.4.5 AUTOTUNE (Cont.)

FAILURE MODES

The conditions for performing an autotune are monitored by the Tune menu parameter 'State'. If autotune is not successful error conditions are read by this parameter as follows:

Timeout	Set if any one stage is not completed within an hour. Possible causes are the loop being open circuit, or not responding to the controller demands. Some heavily lagged systems may produce a timeout if the cooling rate is very slow.
TI Limit	This is set if Autotune calculates a value for the integral term which is greater than the maximum allowable (99999 seconds). This indicates that the loop is not responding or that the tune is taking too long.
R2G Limit	Error occurs if the calculate value of R2G is outside the range 0.1 to 10.0. R2G limit can occur if the gain difference between heating and cooling is too large, or if the controller is configured for heat/cool, but the heating and/or cooling device is turned off or not working correctly.

B2.4.6 Manual tuning

If, for any reason, automatic tuning gives unsatisfactory results the controller can be tuned manually. There are a number of standard methods for manual tuning, the Zeigler-Nichols method being described here:

1. Adjust the setpoint to its normal running conditions (assumed to be above the PV so that 'heat only' is applied.
2. Set the integral and derivative times (Ti and Td) to 'Off'
3. Set High and Low cutback (CBH and CBL) to 'Auto'.
4. If the PV is stable (not necessarily at the setpoint), reduce the proportional band (PB) such that the PV just starts to oscillate, leaving time between adjustments to allow the loop to stabilise. Make a note of the PB at this point (PB′), and also note the oscillation period ('T').
   If the PV is already oscillating measure the oscillation period ('T') and then gradually increase PB to the point at which oscillation just ceases. Make a note of the PB (PB′) at this point.
5. If the controller is fitted with a cooling channel, enable this now.
6. Observe the oscillation waveform and adjust 'R2G' until a symmetrical wave form is observed (Figure B2.4.6).
7. Set PB, Ti and Td according to table B2.4.6.

Control type	PB	Ti	Td
Proportional only	2 × PB′	Off	Off
P + I	2.2 × PB′	0.8 × T	Off
P + I + D	1.7 × PB′	0.5 × T	0.12 × T

Table B2.4.6 Calculate parameter values

B2.4.6 MANUAL TUNING (Cont.)

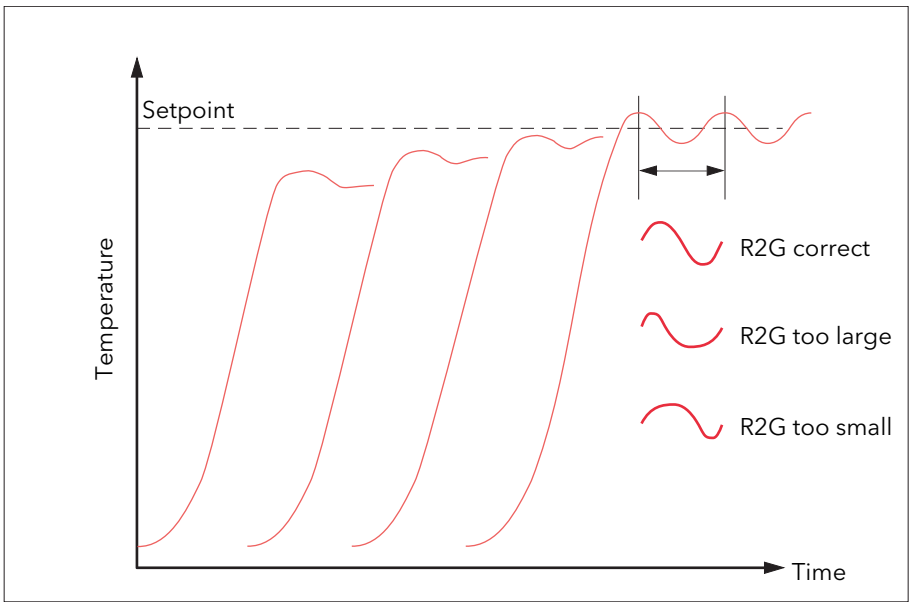


Figure 2.4.6a Relative Cool Gain

CUTBACK VALUES

The PID terms calculated from Table 2.4.6, above, should be entered before the cutback values are set.

The above procedure sets up the parameters for optimum steady state control. If unacceptable levels of overshoot or undershoot occur during start-up, or for large step changes in PV, then the cutback parameters should be set manually, as follows:

1. Initially set the cutback values to one proportional bandwidth converted into display units. This can be calculated by taking the value in percent that has been installed into the parameter 'PB' and entering it into the following formula:

   PB/100 × Span of controller = Cutback High and Cutback Low
   For example, if PB = 10% and the span of the controller is 0 to 1200°C, then
   Cutback High = Cutback Low = 10/100 × 1200 = 120

2. If overshoot is observed following the correct settings of the PID terms increase the value of 'CBL' by the value of the overshoot in display units. If undershoot is observed increase the value of the parameter 'CBH' by the value of the undershoot in display units.

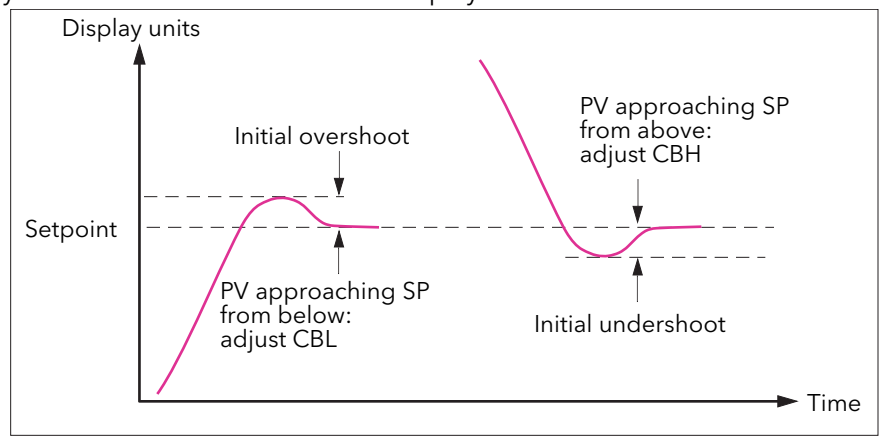


Figure 2.4.6b Manual Cutback setting

B2.5 SETPOINT

The controller setpoint is the Working Setpoint which can be derived from:-

1. SP1 or SP2, both of which are manually set by the user and can be switched into use by an external signal or via the user interface.
2. From an external (remote) analogue source
3. The output of a programmer function block.

B2.5.1 Setpoint function block

As well as providing a setpoint, the function block also provides:

1. The ability to limit the rate of change of the setpoint before it is applied to the control algorithm.
2. Upper and lower limits. These are defined as setpoint limits, 'SP High Limit' and 'SP Low Limit', for the local setpoints and instrument range high and low for other setpoint sources.

> Note: All setpoints are limited by 'Range High' and 'Range Low' so that if 'SP High Limit', for example, is set higher than 'Range High', then 'SP High Limit' is ignored and the setpoint is limited at the 'Range High' value.

User configurable methods for tracking are available, such that the transfers between setpoints and between operating modes do not cause 'bumps' in the setpoint.

Figure B2.5.1, below, shows the function block schematic.

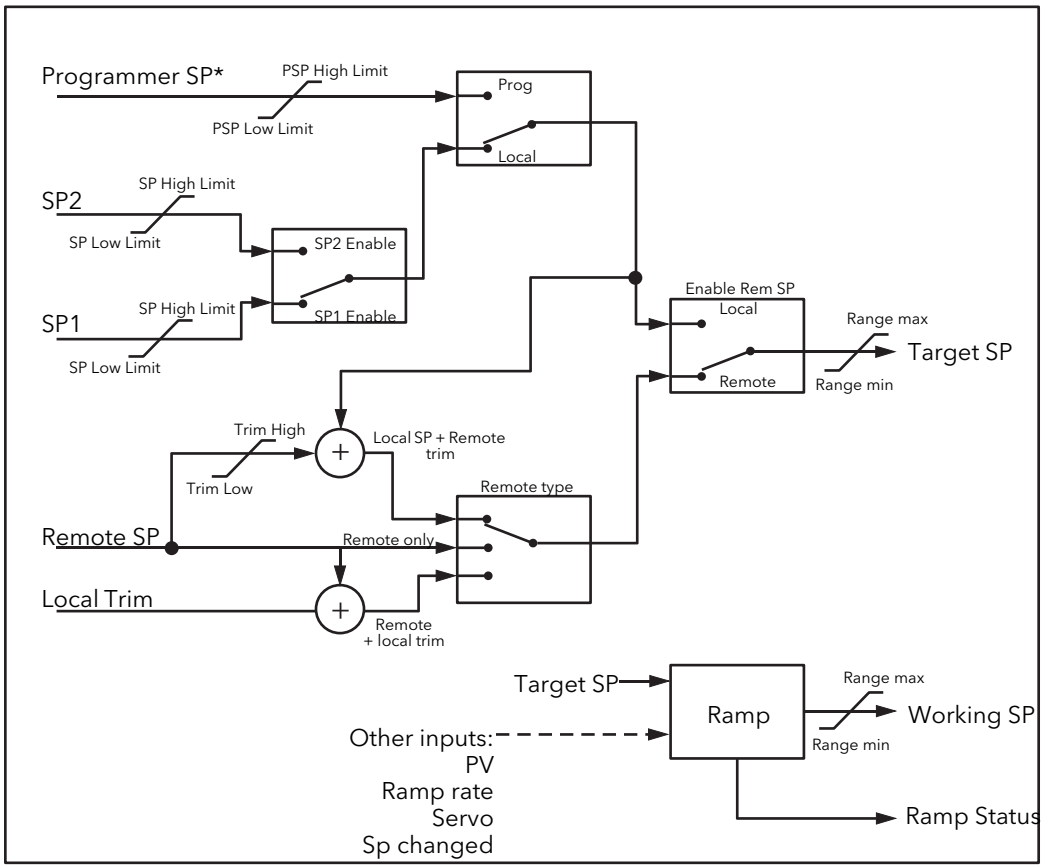


Figure 2.5.1 Setpoint Function block

> *Note: Programmer not available this release.

B2.5.2 Setpoint Limits

The setpoint generator provides limits for each of the setpoint sources as well as an overall set of limits for the loop. These are summarised in figure 2.5.2, below.

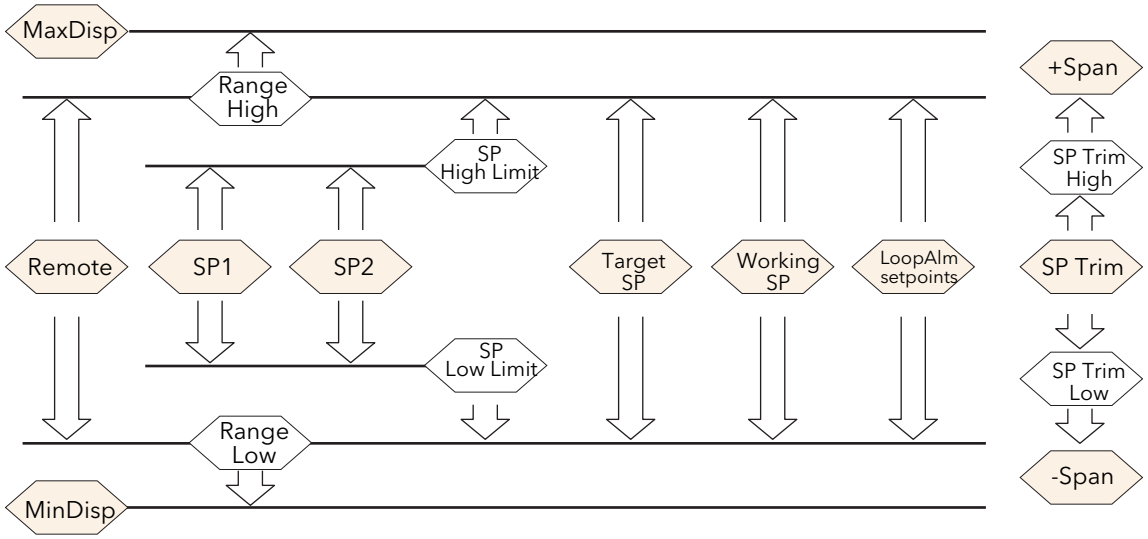


Figure 2.5.2 Setpoint Limits

'Range High' and 'Range Low' provide the range information for the control loop. They are used in control calculations to generate proportional bands. Span = Range High – Range Low.

B2.5.3 Setpoint Rate Limit

This symmetrical rate limiter allows the rate of change of setpoint to be controlled, preventing step changes in the setpoint. The limit is applied to the working setpoint which includes setpoint trim.

Rate limiting is enabled using the 'Rate' parameter. If this is set to '0' then any change made to the setpoint will be effective immediately. If it is set to any other value, then a change in the setpoint will be have rate limiting applied at the value set, in units per minute. Rate limit applies to SP1, SP2 and Remote SP.

When rate limit is active 'Rate Done' displays 'No'. When the setpoint has been reached the value changes to 'Yes'.

When 'Rate' is set to a value (other than 'Off') an additional parameter 'SP Rate Disable' is displayed which allows the setpoint rate limit to be turned off and on without the need to adjust the 'Rate' parameter between Off and a working value.

If the PV is in sensor break, the rate limit is suspended and the working setpoint takes the value of 0. On sensor break being released the working setpoint goes from 0 to the selected setpoint value at the rate limit.

B2.5.4 Setpoint Tracking

The setpoint used by the controller may be derived from a number of sources. For example:-

1. Local setpoints SP1 and SP2. These may be selected through the front panel using the parameter 'SP Select', through digital communications or by configuring a digital input which selects either SP1 or SP2. This might be used, for example, to switch between normal running conditions and standby conditions. If Rate Limit is switched off the new setpoint value is adopted immediately when the switch is changed.
2. A programmer* generating a setpoint which varies over time. When the programmer is running, the 'Track SP' and 'Track PV' parameters update continuously so that the programmer can perform its own servo. This is sometimes referred to as 'Program Tracking'.
3. From a Remote analogue source. The source could be an external analogue input into an analogue input module wired to the 'Alt SP' parameter or a User Value wired to the 'Alt SP' parameter. The remote setpoint is used when the parameter 'Alt SP Enable' is set to 'Yes'.

Setpoint tracking (sometimes referred to as Remote Tracking) ensures that the Local setpoint adopts the Remote setpoint value when switching from Local to Remote to maintain bumpless transfer from Remote to Local. Bumpless transfer does not take place when changing from Local to Remote.

Note: If Rate Limit is applied, the setpoint will change at the set rate, when changing from Local to Remote.

B2.5.5 Manual Tracking

When the controller is operating in manual mode the currently selected SP (SP1 or SP2) tracks the PV. When the controller resumes automatic control there will be no step change in the resolved SP. Manual tracking does not apply to the remote setpoint or programmer setpoint.

*Note: Programmer not available this release.

B2.6 OUTPUT

B2.6.1 Introduction

The output function block selects the correct output sources to be used, determines whether to heat or cool and then applies limits. Power feed forward and non-linear cooling are also applied.

It is this block that manages the output in exception conditions such as start up and sensor break.

The outputs, 'Ch1 Output' and 'Ch2 Output', are normally wired to a digital I/O where they are converted into analogue or time proportioned signals for electrical heating, cooling or valve movement.

B2.6.2 Output Limits

Figure B2.6.2 shows where output limits are applied.

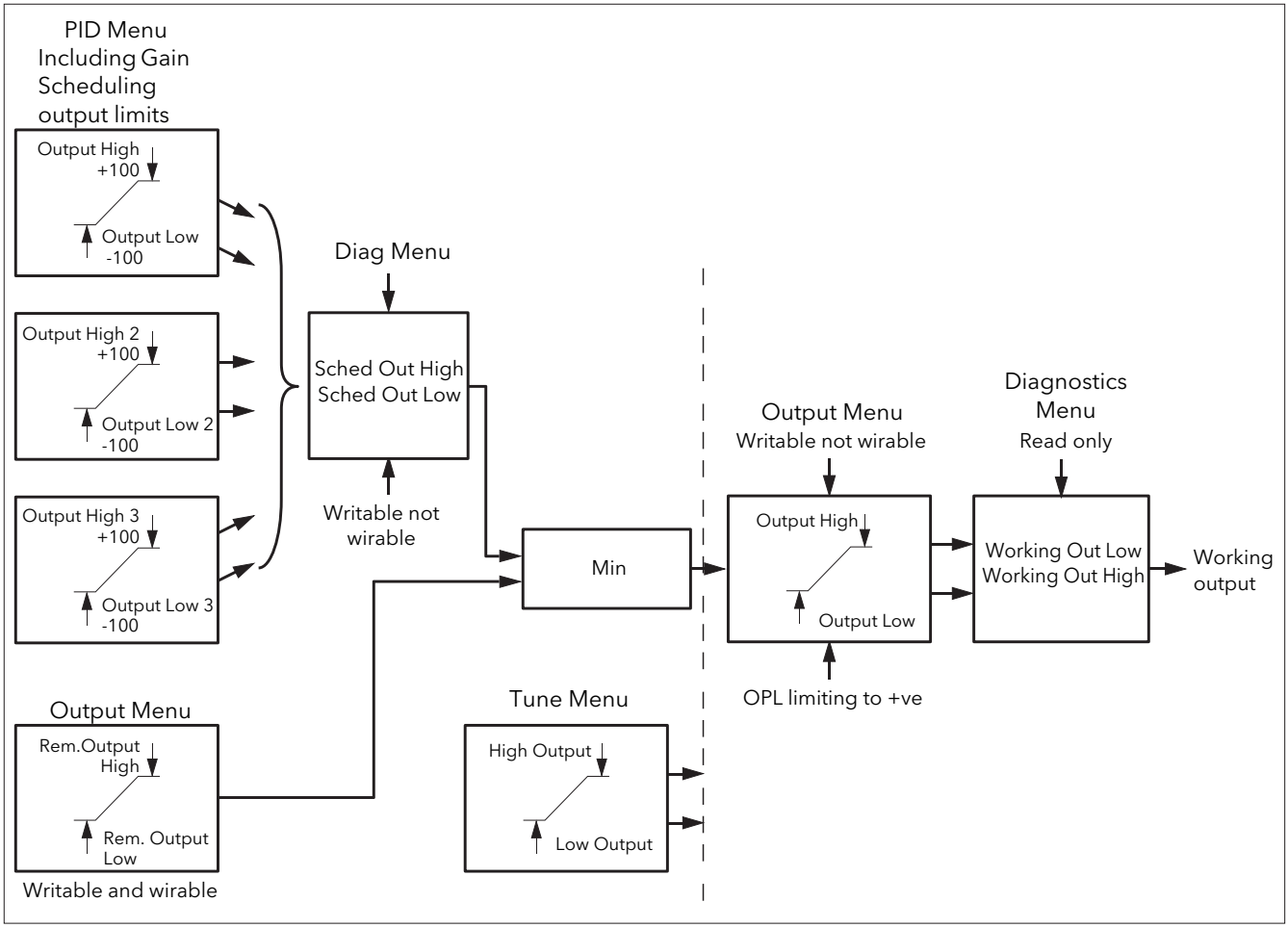


Figure B2.6.2 Output Limits

Notes:

1. Individual output limits may be set in the PID list for each set of PID parameters when gain scheduling is in use.
2. Limits may also be applied from an external source. These are 'Rem.Output High' and 'Rem. Output Low' found in the Output menu. These parameters are wireable; for example they may be wired to an analogue input module so that a limit may applied through some external strategy. If these parameters are not wired ±100% limit is applied every time the instrument is powered up.

(Continued)

B2.6.2 OUTPUT LIMITS (Cont.)

Notes (Continued)

3. The tightest limits (between Remote and PID) are connected to the output where an overall limit is applied using parameters 'Output High' and 'Output Low'.
4. 'Working Out High' and 'Working Out low' found in the Diagnostics list are read only parameters showing the overall working output limits.
5. The tune limits are a separate part of the algorithm and are applied to the output during the tuning process. The overall limits 'Output Hi' and 'Output Lo' always have priority.

B2.6.3 Output Rate Limit

The output rate limiter is a rate-of-change limiter, set in (%/sec) which prevents step changes in output power being demanded. Rate limiting is performed by determining the direction in which the output is changing, and then incrementing or decrementing the Working Output (Main menu) until it equals the required output (Target OP).

The amount to increment or decrement is calculated using the sampling rate of the algorithm (125ms) and the selected rate limit. If the change in output is less than the rate limit increment the change takes effect immediately.

The rate limit direction and increment is calculated on every execution of the rate limit. Therefore, if the rate limit is changed during execution, the new rate of change takes immediate effect. If the output is changed whilst rate limiting is taking place, the new value takes immediate effect on the direction of the rate limit and in determining whether the rate limit has completed.

The rate limiter is self-correcting such that if the increment is small it is accumulated until it takes effect.

The output rate limit is active when the loop is in both auto and manual modes, and during autotune.

B2.6.4 Sensor Break Mode

If a Sensor break is detected by the measurement system the loop reacts in one of two ways, according to the configuration of 'Sbrk Mode' ('Safe' or 'Hold'). On exit from sensor break the transfer is bumpless – the power output starts controlling again from the current operating setpoint and moves, under PID closed-loop control, from its pre-set value to the control value.

SAFE

If set to 'Safe', the output adopts a pre-set level (Sbrk OP). If rate limit is not configured, the output steps to the Sbrk OP value, otherwise it ramps to this value at the rate limit.

HOLD

If set to 'Hold' the output remains at its current value. If Output Rate Limit (Rate) has been configured a small step may be seen as the working output will limit to the value existing two iterations ago.

B2.6.5 Forced Output

This feature enables the user to specify what the output of the loop should do when moving from automatic control to manual control. The default is that the output power is maintained but it is then adjustable by the user.

If Manual Mode is set to 'Step', the user can set a manual output power value and on transition to manual the output will be forced to that value.

If Manual Mode is set to 'Track' the output steps to the forced manual output and then subsequent edits to the output power are tracked back into the manual output value.

If Manual Mode is set to 'Last Man. Out' then when moving from automatic to manual mode, the output adopts the last manual output value.

B2.6.6 Power Feed Forward

Power feed forward is used when driving an electrical heating element. It monitors the line voltage and compensates for fluctuations before they affect the process temperature. The use of this will give better steady state performance when the line voltage is not stable.

It is mainly used for digital type outputs which drive contactors or solid state relays. Because it only has value in this type of application it can be switched off using the parameter 'Pff En'. It should also be disabled for any non-electric heating process. It is not necessary when Eurotherm analogue thyristor control is used since compensation for power changes is included in the thyristor driver.

Consider a process running at 25% power, with zero error and then the line voltage falls by 20%. The heater power would drop by 36% because of the square law dependence of power on voltage. A drop in temperature would result. After a time, the thermocouple and controller would sense this fall and increase the ON-TIME of the contactor just enough to bring the temperature back to set point. Meanwhile the process would be running a bit cooler than optimum which may cause some imperfection in the product.

With power feed forward enabled the line voltage is monitored continuously and ON-TIME increased or decreased to compensate immediately. In this way the process need never suffer a temperature disturbance caused by a line voltage change.

'Power Feed forward' should not be confused with 'Feed forward' which is described in section B2.6.8.

B2.6.7 Cool Type

Cooling methods vary from application to application. For example, an extruder barrel may be cooled by forced air (from a fan), or by circulating water or oil around a jacket. The cooling effect will be different depending on the method. 'Cool Type' (appears only if the 'setup' parameter 'Ch2 Control' is set to 'PID') is used to accommodate different types of cooling methods as follows:

LINEAR

The cooling algorithm may be set to linear where the controller output changes linearly with the PID demand signal.

OIL COOLING

'Cool Type' = 'Oil'. As oil is, to all intents and purposes, non-evaporative, oil cooling is pulsed in a linear manner.

WATER COOLING

If the area being cooled is running well above 100°C, then the first few pulses of water flash into steam giving greatly increased cooling due to the latent heat of evaporation. When the area cools, less (or even no) evaporation takes place and the cooling is less effective.

Setting 'Cool Type' to 'Water' delivers much shortened pulses of water for the first few percent of the cooling range, when the water is likely to be flashing into steam. This compensates for the transition out of the initial strong evaporative cooling.

FAN COOLING

'Cool Type = 'Fan'. Fan cooling is much gentler than water cooling and not so immediate or decisive (because of the long heat transfer path through the process mechanics). With fan cooling, a cool gain setting of three upwards is typical. Delivery of pulses to the blower is non linear, this non-linearity being caused by a combination of forced air movement and fan efficiency as a function of air velocity (e. g. the efficiency of a fan when producing a low speed (laminar) air flow is different from its efficiency when producing a high-speed, turbulent flow.

B2.6.8 Feed forward

Feed forward is a method of adding an extra scalable component to the PID output, before any limiting. It can be used, for example, in the implementation of cascade loops and constant head control or it can be used to pre-load the control signal with a value close to that which is required to achieve the setpoint, thus improving system response. Feed forward (FF) is applied such that the PID output is limited by trim limits and acts as a trim on a FF value. The FF value is derived either from the PV or setpoint by scaling the PV or SP by the 'FF Gain' and 'FF Offset'. Alternatively, a remote value may be used for the FF value, but this is not subject to any scaling. The resultant FF value is added to the limited PID OP and becomes the PID output as far as the output algorithm is concerned. The feedback value then generated must then have the FF contribution removed before being used again by the PID algorithm. The diagram below shows how feed forward is implemented.

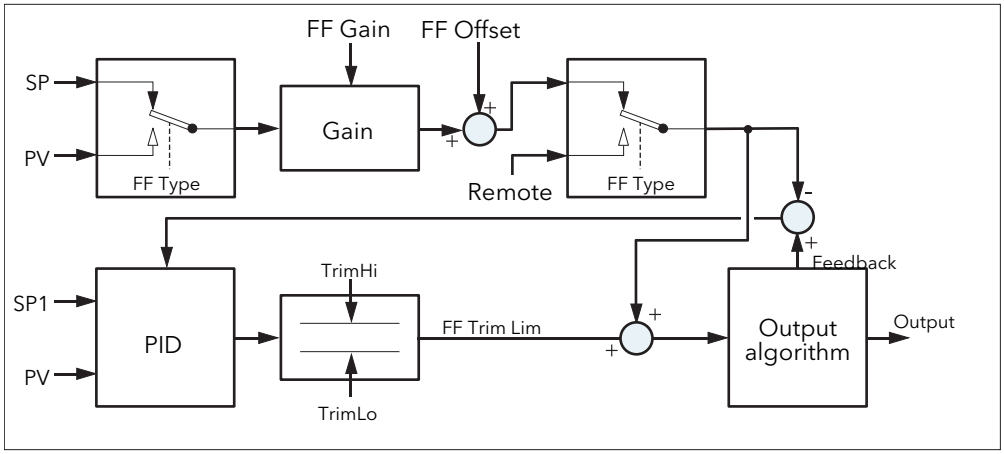


Figure B2.6.8 Implementation of Feed forward

B2.6.9 Effect of Control Action, Hysteresis and Deadband

CONTROL ACTION

For temperature control 'Control Act' should be set to 'Rev'. For a PID controller this means that the heater power decreases as the PV increases. For an on/off controller, output 1 (usually heat) will be on (100%) when PV is below the setpoint and output 2 (usually cool) will be on when PV is above the setpoint.

HYSTERESIS

Hysteresis applies to on/off control only and is set in the units of the PV. In heating applications the output will turn off when the PV is at setpoint. It will turn on again when the PV falls below SP by the hysteresis value. This shown in Figures B2.6.9a and B2.6.9b below for a heat and cool controller.

Hysteresis is intended to prevent the output from repeated switching on and off 'chattering' at the control setpoint. If the hysteresis is set to 0 then even the smallest change in the PV when at setpoint will cause the output to switch. Hysteresis should be set to a value which provides an acceptable life for the output contacts, but which does not cause unacceptable oscillations in the PV.

If this performance is unacceptable, it is recommended that PID control be used instead.

DEADBAND

Deadband 'Ch2 Deadband' can operate on both on/off control or PID control where it has the effect of extending the period when no heating or cooling is applied. In PID control the effect is modified by both the integral and derivative terms. Deadband might be used in PID control, for example, where actuators take time to complete their cycle thus ensuring that heating and cooling are not being applied at the same time. Deadband is likely to be used, therefore, in on/off control only. Figure B2.6.9b, below, adds a deadband of 20 to the first example in figure B2.6.9a.

B2.6.9 EFFECT OF CONTROL ACTION, HYSTERESIS AND DEADBAND (Cont.)

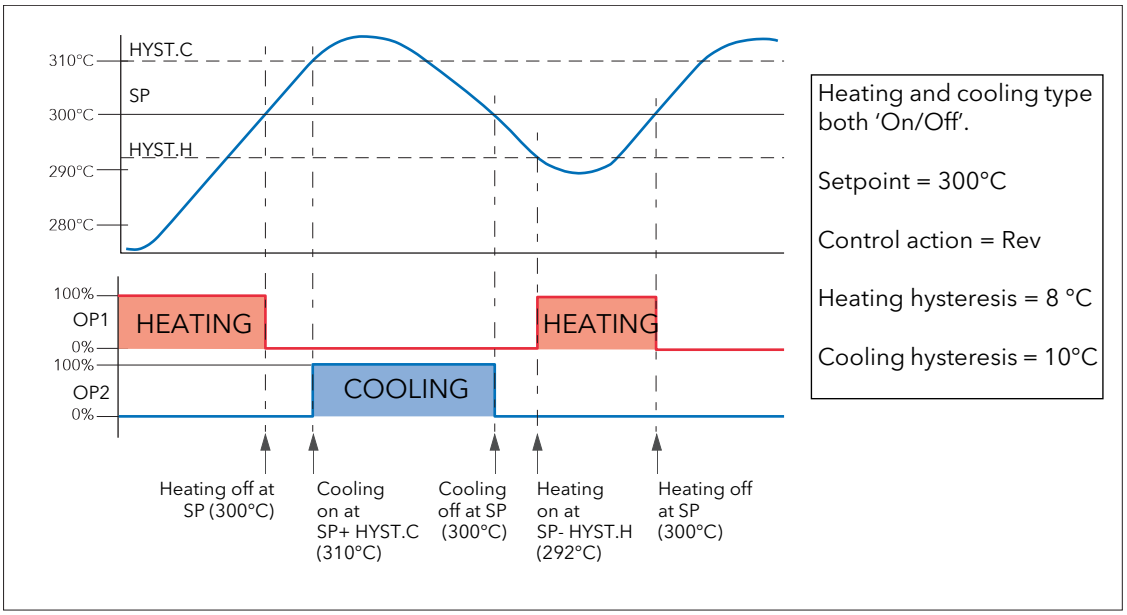


Figure B2.6.9a Deadband OFF

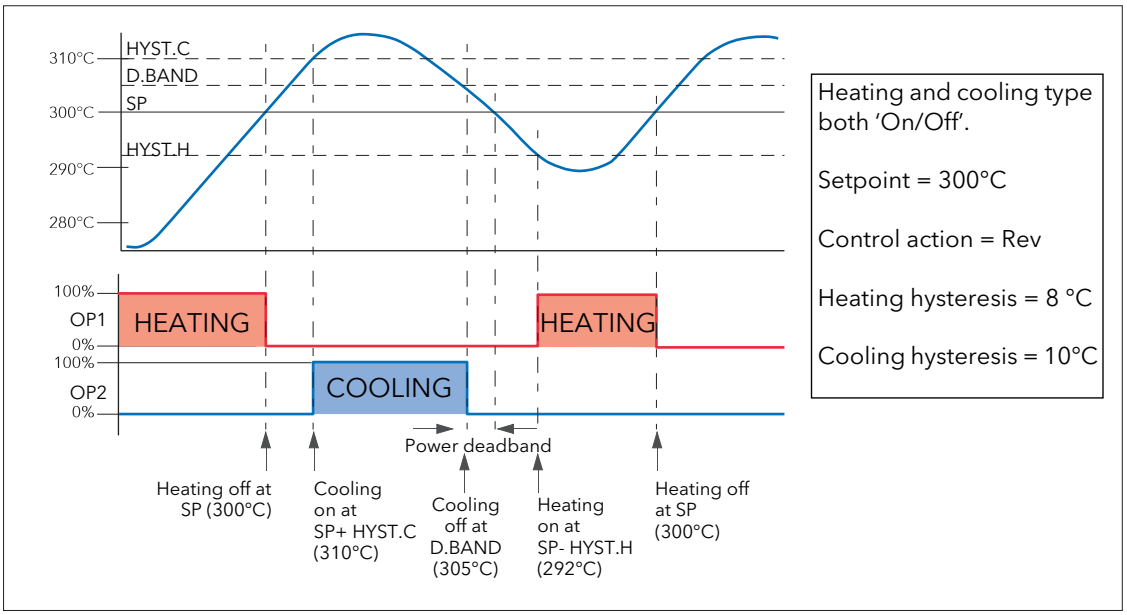


Figure B2.6.9b Deadband ON set at 50% of Cooling.

B2.6.10 Valve nudge

For systems configured as Unbounded Valve Positioning (VPU) - set up in Loop Setup configuration Ch1(2) control), it is possible to move the valve in small increments towards the open position (Nudge Raise) or towards the closed position (Nudge Lower). The trigger for such nudging can be a digital input (e.g. contact closure) 'wired' to the nudge raise or lower parameter, the up or down arrow keys or a command received over the serial link.

The nudge command causes the valve drive output to drive the valve for either the minimum on time, or for as long as the command is 'true', whichever is the longer (note 2). The default minimum on time is 125ms, but this can be edited in the configuration for the relevant output relay (section 4.7.2).

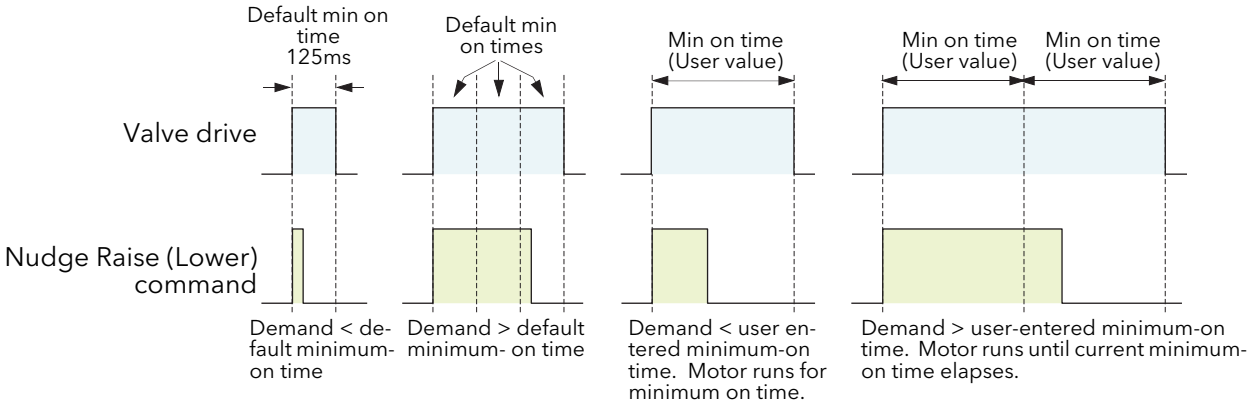


Figure B2.6.10 Valve nudge examples

Notes:

1. If Ch1 is set to VPU, Nudge operates the channel 1 valve, no matter what Ch2 is set to. If Ch1 is not set to VPU, and Ch2 is set to VPU then the nudge operates on channel 2 valve.
2. The minimum on time is continuously retriggered. This means that if a minimum on time of (say) 10 seconds has been configured, then the valve may continue to move for up to 10 seconds after the command has been removed. That is, it continues until the current minimum on time period has expired.

B2.6.11 Time Proportioning

PID controllers somtimes use Time Proportioning to control the average power to the load. This is done by repeatedly switching the output on for a period (T_{on}) and then off for a period (T_{off}). The total period (T_{on} + T_{off}) is called the 'cycle time'. During each cycle, the average power delivered to the load is:

$P_{Avg} = P_{Heater}$ x Duty cycle,

where 'P_{Heater}' is the actual transferred heater (or cooler) power and Duty cycle = $T_{on}/(T_{on} + T_{off})$, normally represented as a percentage value.

The PID controller calculates the Duty Cycle (the PID output control signal from 0 to 100%) and provides a Minimum on time between 100ms to 150 seconds.

Figure B2.6.11 shows how T_{on}, T_{off} and cycle time vary with demand %.

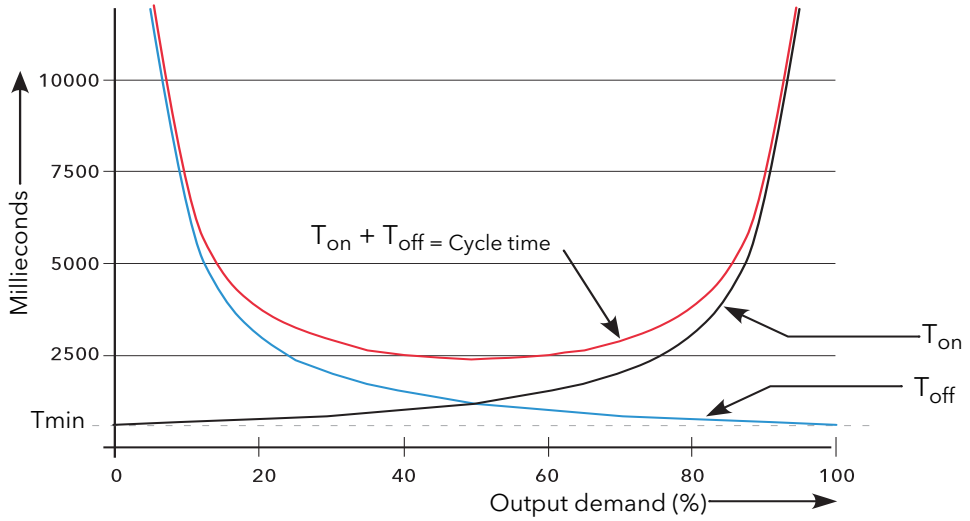


Figure B2.6.11 Time proportioning curves (Minimum on time = 625ms)

Note: For this instrument, only 'Min on time' is configurable

B2.7 DIAGNOSTICS

See section 4.6.7 for definitions of these parameters

Appendix C: REFERENCE

C1 BATTERY REPLACEMENT

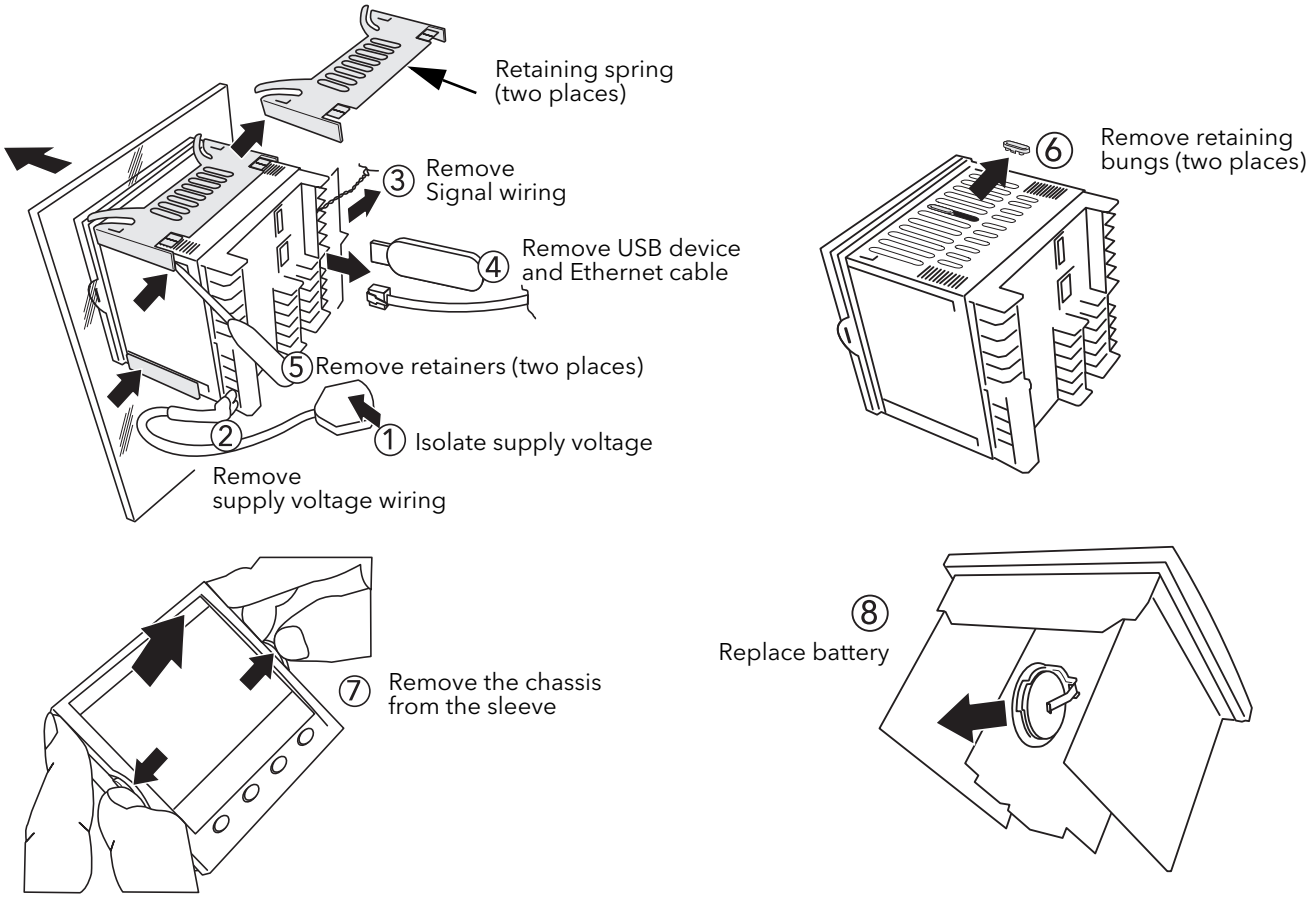
The battery can be replaced only after the unit has been withdrawn from the panel. It is therefore normally necessary to unwire the instrument before changing the battery.

WARNING

Before removing the supply voltage wiring, isolate the supply voltage and secure it against unintended operation.

Note: The new battery must be installed within 10 seconds of the exhausted battery's removal, or data will be lost.

1. Isolate the supply voltage and secure it against accidental operation.
2. Remove supply voltage wiring from the rear terminals.
3. Remove all signal wiring
4. Remove the Ethernet cable and USB device if fitted.
5. Remove the two securing springs, using a small screwdriver if necessary.
6. Prise the two chassis-retaining bungs, using a small screwdriver if necessary.
7. Ease the latching ears outwards, whilst pulling forwards on the bezel, until the chassis is free of the sleeve.
8. Replace the battery. Recycle the exhausted battery according to local procedures.
9. Reinsert the chassis into the sleeve, and secure it using the chassis-retaining bungs previously removed.
10. Reinstall the chassis into the panel and secure it using the retaining springs previously removed.
11. Reinstall all wiring, the Ethernet cable and USB device, if any.
12. Reset the date and time as described in section 4.1.1.

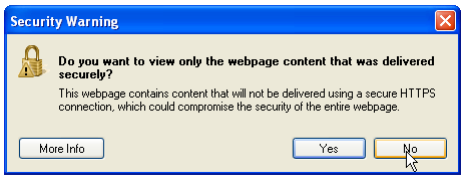


C2 SETTING UP AN FTP SERVER USING FILEZILLA

C2.1 DOWNLOADING

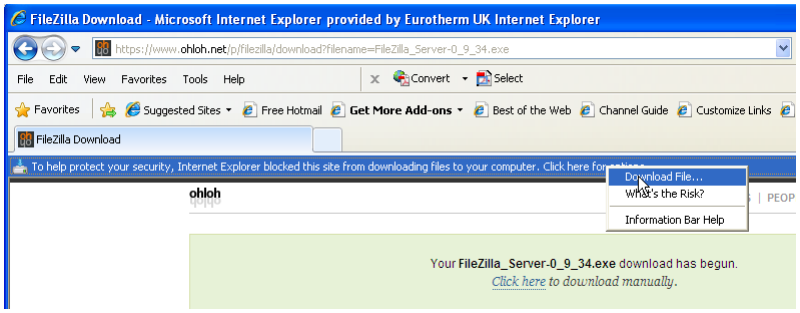
'FileZilla' is a free download from the internet (search for 'FileZilla server download').

1. Download the latest version, following the instructions on the screen.


Security Warning
Do you want to view only the webpage content that was delivered securely?
This webpage contains content that will not be delivered using a secure HTTPS connection, which could compromise the security of the entire webpage.
More Info
Yes
No

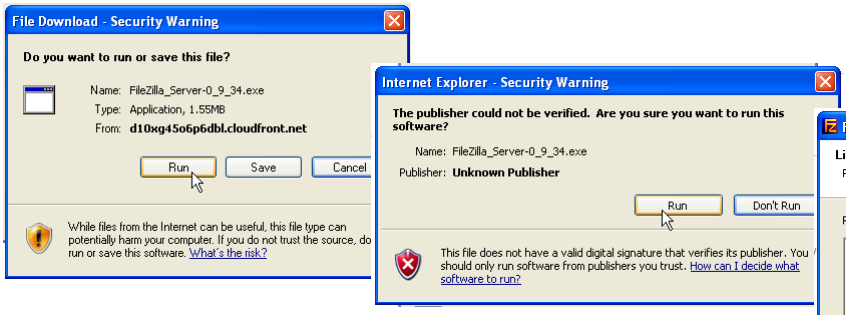
2. Answer 'No' to the question 'Do you want to view only the webpage content that was delivered securely'.

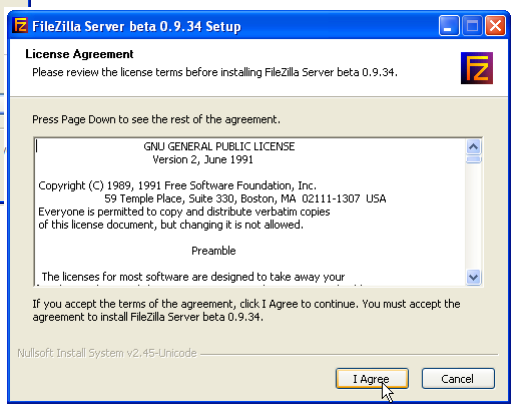
3. If necessary enable file download.


FileZilla Download - Microsoft Internet Explorer provided by Eurotherm UK Internet Explorer
File Edit View Favorites Tools Help
Favorites Suggested Sites Free Hotmail Get More Add-ons Best of the Web Channel Guide Customize Links
FileZilla Download
Download File...
What's the Risk?
Information Bar Help
ohloh
Your FileZilla_Server-0_9_34.exe download has begun.
Click here to download manually.

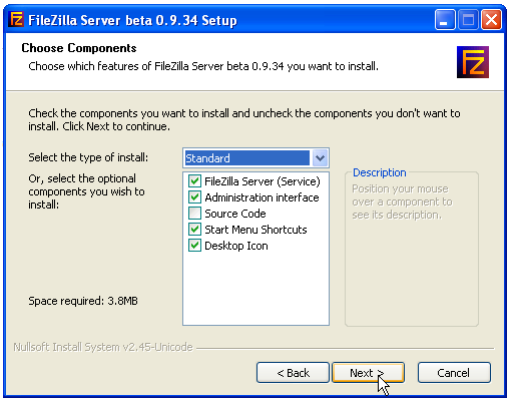
4. In the 'Do you want to run or save this file' Security Warning window- click on 'Run'

5. In the 'The Publisher could not be verified..., Security Warning window, click on 'Run'


File Download - Security Warning
Do you want to run or save this file?
Name: FileZilla_Server-0_9_34.exe
Type: Application, 1.55MB
From: d10xg45o6p6dbl.cloudfront.net
Run
Save
Cancel
While files from the Internet can be useful, this file type can potentially harm your computer. If you do not trust the source, do run or save this software. What's the risk?
Internet Explorer - Security Warning
The publisher could not be verified. Are you sure you want to run this software?
Name: FileZilla_Server-0_9_34.exe
Publisher: Unknown Publisher
Run
Don't Run
This file does not have a valid digital signature that verifies its publisher. You should only run software from publishers you trust. How can I decide what software to run?

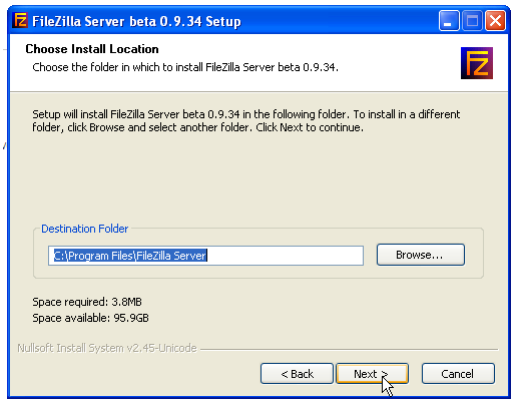

FileZilla Server beta 0.9.34 Setup
License Agreement
Please review the license terms before installing FileZilla Server beta 0.9.34.
Press Page Down to see the rest of the agreement.
GNU GENERAL PUBLIC LICENSE
Version 2, June 1991
Copyright (C) 1989, 1991 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.
Preamble
The licenses for most software are designed to take away your
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install FileZilla Server beta 0.9.34.
Nullsoft Install System v2.45-Unicode
I Agree
Cancel

6. Agree or cancel the License agreement. If 'Agree', choose 'Standard' as the type of install.

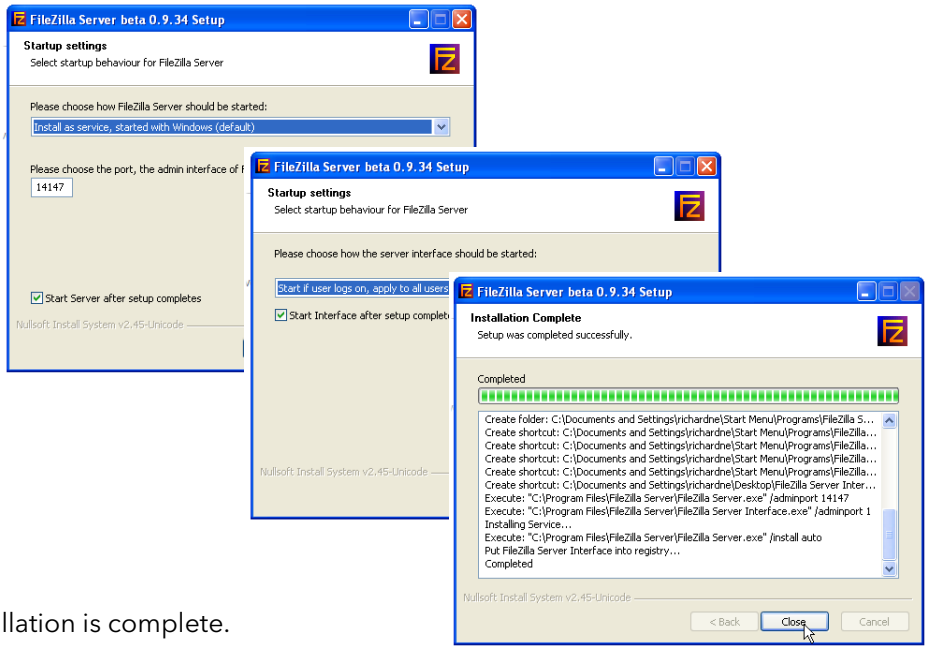

FileZilla Server beta 0.9.34 Setup
Choose Components
Choose which features of FileZilla Server beta 0.9.34 you want to install.
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.
Select the type of install:
Standard
Or, select the optional components you wish to install:
FileZilla Server (Service)
Administration interface
Source Code
Start Menu Shortcuts
Desktop Icon
Description
Position your mouse over a component to see its description.
Space required: 3.8MB
Nullsoft Install System v2.45-Unicode
< Back
Next >
Cancel

C2.1 DOWNLOADING (Cont.)

7. Choose the destination for the file

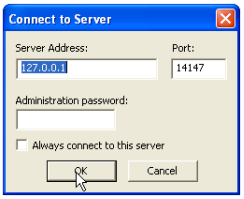

FileZilla Server beta 0.9.34 Setup
Choose Install Location
Choose the folder in which to install FileZilla Server beta 0.9.34.
Setup will install FileZilla Server beta 0.9.34 in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.
Destination Folder
C:\Program Files\FileZilla Server
Browse...
Space required: 3.8MB
Space available: 95.9GB
Nullsoft Install System v2.45-Unicode
< Back
Next >
Cancel

8. Select startup settings


FileZilla Server beta 0.9.34 Setup
Startup settings
Select startup behaviour for FileZilla Server
Please choose how FileZilla Server should be started:
Install as service, started with Windows (default)
Please choose the port, the admin interface of
14147
Start Server after setup completes
Nullsoft Install System v2.45-Unicode
FileZilla Server beta 0.9.34 Setup
Startup settings
Select startup behaviour for FileZilla Server
Please choose how the server interface should be started:
Start if user logs on, apply to all users
Start Interface after setup complet
Nullsoft Install System v2.45-Unicode
FileZilla Server beta 0.9.34 Setup
Installation Complete
Setup was completed successfully.
Completed
Create folder: C:\Documents and Settings\richardne\Start Menu\Programs\FileZilla S...
Create shortcut: C:\Documents and Settings\richardne\Start Menu\Programs\FileZilla...
Create shortcut: C:\Documents and Settings\richardne\Start Menu\Programs\FileZilla...
Create shortcut: C:\Documents and Settings\richardne\Start Menu\Programs\FileZilla...
Create shortcut: C:\Documents and Settings\richardne\Start Menu\Programs\FileZilla...
Create shortcut: C:\Documents and Settings\richardne\Desktop\FileZilla Server Inter...
Execute: "C:\Program Files\FileZilla Server\FileZilla Server.exe" /adminport 14147
Execute: "C:\Program Files\FileZilla Server\FileZilla Server Interface.exe" /adminport 1
Installing Service...
Execute: "C:\Program Files\FileZilla Server\FileZilla Server.exe" /install auto
Put FileZilla Server Interface into registry...
Completed
Nullsoft Install System v2.45-Unicode
< Back
Close
Cancel

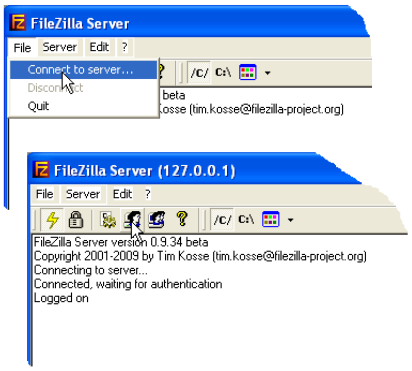
9. Click on Close when Installation is complete.

10. Click 'OK' in the 'Connect to Server' window.



C2.2 SERVER SETUP

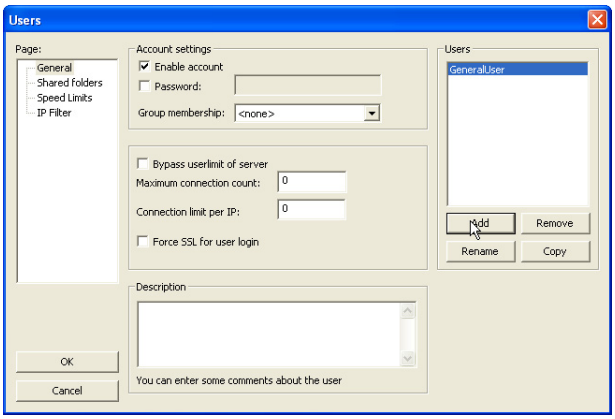
1. Create a new folder (directory) called, for this example, 'Archive' in a suitable location such as the C drive, or the desktop.



2. In the Filezilla server window, click on 'File' and select 'Connect to Server'.

   The 'Logged on' message appears

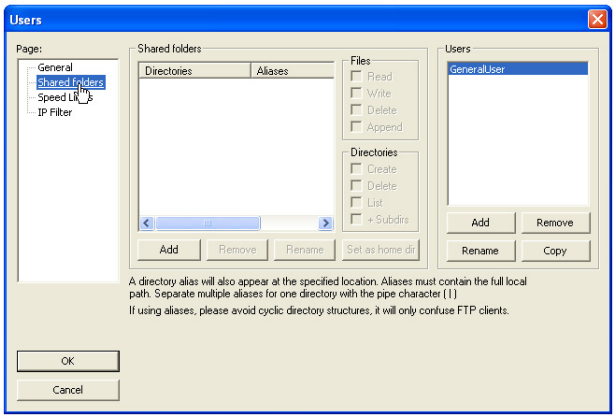
3 In the Edit menu, select 'Users' and in the 'General' page, click on 'Add' and enter a name for the user, then click 'OK'. For this example, 'GeneralUser' has been used, but it may be more advantageous to use 'Anonymous' because this is the default name in the recorder/controller. Click on 'OK'.



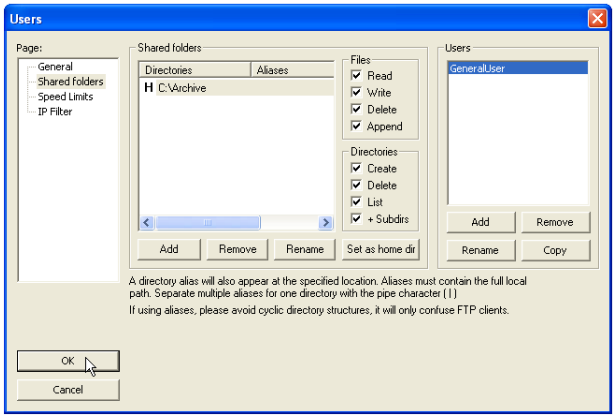
4 In the Edit menu, select 'Users' and in the 'Shared Folders' page, click on 'Add'

   A browse window opens allowing the user to select the new folder ('Archive') created in step 1, above.

   When OK has been clicked to confirm the selection, the new folder appears in the centre window (with an 'h' next to it to indicate that this is the home folder for this ftp user setup.

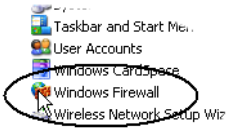


5. Click on all the 'File' and 'Directory' enable tick boxes, then click OK

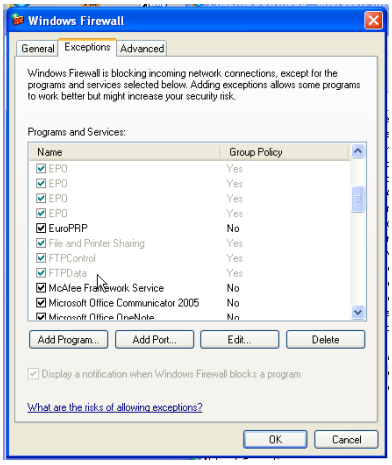


C2.3 PC SETUP

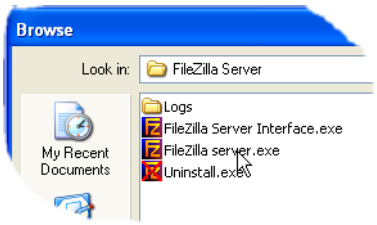
1. Operate the 'Start' button, and select 'Control Panel' from the window that appears. Double click on 'Windows Firewall'



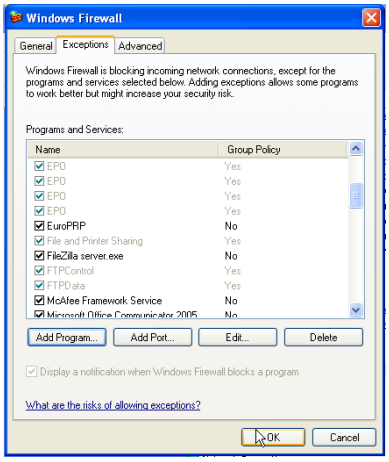
2. Click on the 'Exceptions' tab in the window that appears, and check that both 'FTPControl' and 'FTPData' are enabled (ticked). If not, the user's IT department should be contacted for advice.



3. Click on 'Add Program...' and browse to the Filezilla destination defined in step 7 of the download section (C2.1). Select 'FileZilla server.exe' and click on 'Open'



'FileZilla server.exe' appears in the Exceptions list.



Click on 'OK'

C2.4 RECORDER/CONTROLLER SET UP

In Network Archiving (section 4.2.2):

1. Enter the IP address of the pc in which the FTP server has been enabled in the 'Primary Server' field.
2. Enter the Primary User name, as entered in step three of the Server setup procedure (section C2.2) above (GeneralUser in this example).
3. Enter the IP address of another suitable pc which has been configured as an ftp server in the 'Sec. Server' field, and enter the relevant 'Sec. User' name.
4. Configure the other unattended archive parameters as required (section 4.2.2).

Note: For the example above, 'Password' was not enabled in the User Accounts setup page (section C2.2), so for this example any Primary (Sec.) password entry is ignored. If a password had been entered in the User Accounts setup, then the Primary (Sec.) Password field would have to contain this password.

C2.5 ARCHIVE ACTIVITY

Once a demand or unattended archive is initiated, the FileZilla Server page shows the activity status as the archive progresses. Figure C2.5 shows a typical page. The top of the page shows the transaction details between the server and any clients to which it is connected. The bottom portion shows details of the files currently being transferred. These files are archived to the 'Archive' folder.

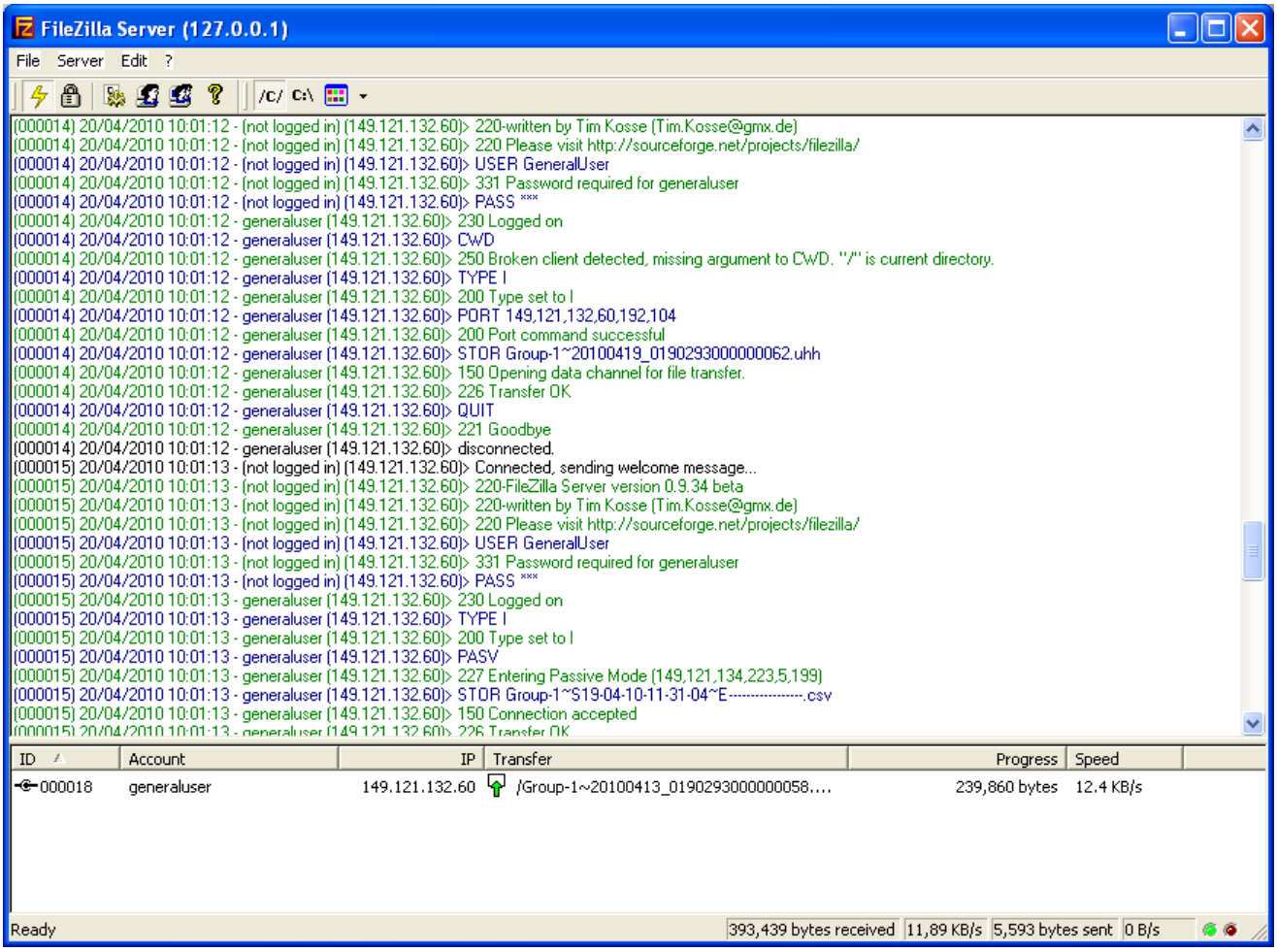


Figure C2.5 FileZilla Server archive activity page

C3 FUNCTION BLOCK DETAILS

C3.1 EIGHT INPUT OR BLOCK

An eight input logical OR block whose output is high (1, On) if any one or more inputs is high (1, On). If more than eight inputs are required, a second block is automatically introduced, as shown in figure C3.1a. The blocks in the figure are given the names 'A' and 'B', where 'A' and 'B' can be any of the 12 available instances.

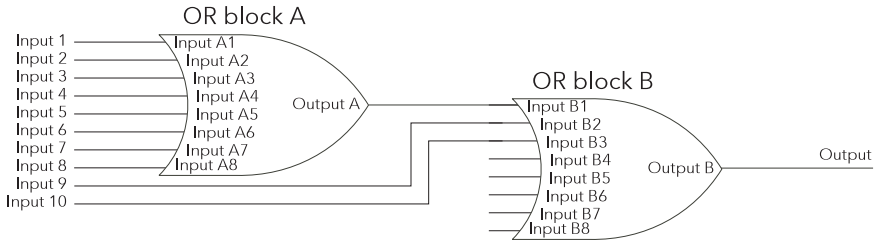


Figure C3.1a Eight input OR block

OR blocks are used automatically by the 'user wiring' when more than one source is wired to the same destination parameter. For example, it may be required that Relay (Digital I/O 2A2B) is to operate if channel 1 alarm 1 and/or channel 2 alarm 1 channels goes active. In such a case, the 'Active' parameter for the two channel alarms would be wired to the same relay's 'PV' parameter.

OR blocks are invisible to the user interface, but the iTools graphical wiring page for this configuration (figure C3.1b), shows that an OR block has been introduced to OR the two alarm outputs together.

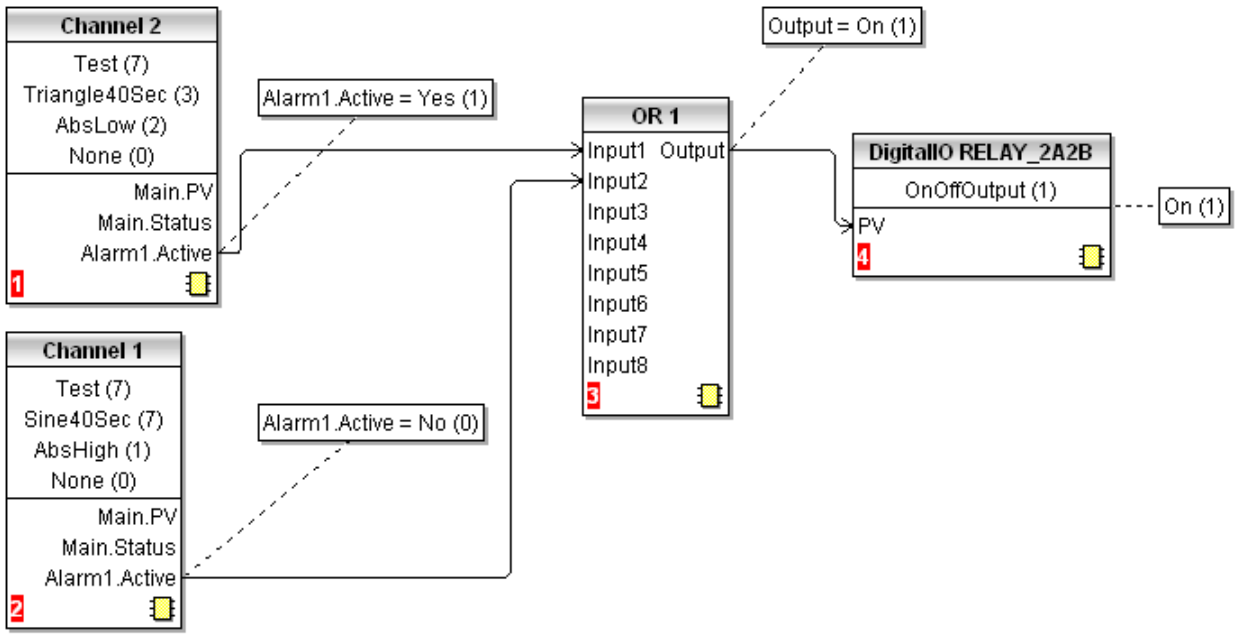


Figure C3.1b iTools representation of OR block usage

C4 TCP PORT NUMBERS

The following TCP ports are made use of by the instrument.

Port	Usage
20	File Transfer protocol (FTP) data
21	FTP control
502	Modbus TCP communications

C5 ISOLATION DIAGRAM

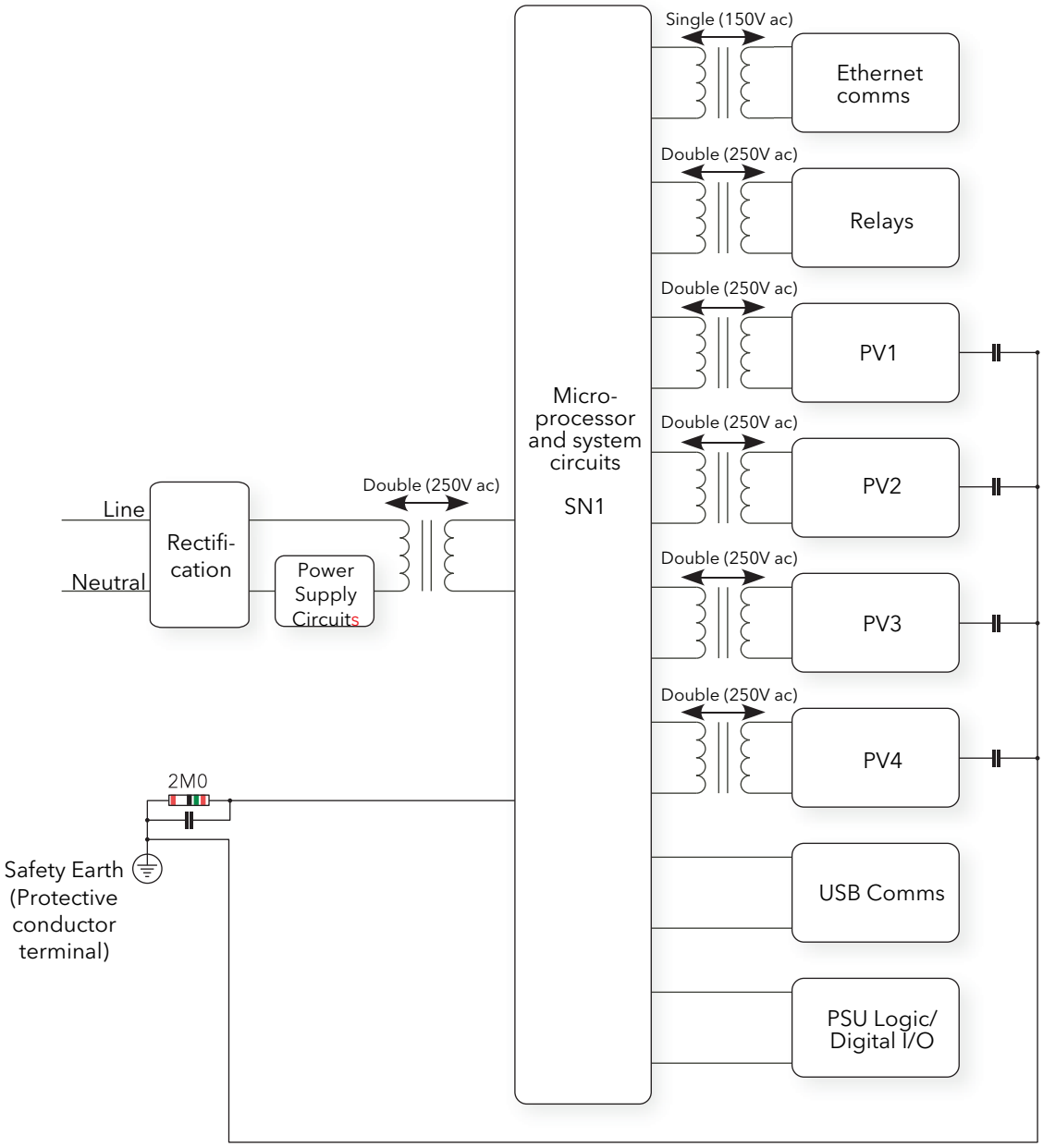


Figure C5 Isolation diagram

Index

Numerics

1 Hour Scroll . . . 24
12 Hour Scroll . . . 24
24 Hour Scroll . . . 24
32-Bit resolution . . . 2

A

About the recorder . . . 30
Abs Hi . . . 47
Abs Low . . . 47
Accents . . . 25
Access levels . . . 15
Account
  Password . . . 31
  Username . . . 31
Acknowledge alarms . . . 13, 48, 71
Acknowledgement . . . 48
Active . . . 48
  Channel . . . 15
  Not acked . . . 47
  Set . . . 59
Acute accent . . . 25
Add . . . 52
  New wire . . . 127
Adding parameters to the Watch list . . . 124
Address . . . 39
Alarm
  Acknowledgement . . . 13
  Configuration . . . 47
  Icons . . . 8
  Message filter . . . 14
  Status . . . 47
  Summary display . . . 13
  Symbol . . . 11
  Types . . . 47, 49
Align Tops/Lefts . . . 119
All Messages . . . 14
Alt SP . . . 60
  Enable . . . 60
Amount . . . 48
Any Alarm/Channel Alarm/Sys Alarm . . . 71
Application blocks supported . . . 135
Archive . . . 17
  All . . . 17
  Disabled/Failed/Timeout error . . . 9
  Menu (Demand) . . . 17
  Rate . . . 37, 133
  To . . . 17
Archiving . . . 36
AT.R2G . . . 58
Auto/Man Access . . . 58
Auto/Manual . . . 137
AutoMan . . . 57
Automatic
  Archive rate . . . 37
  Probe Cleaning . . . 67
Autotune . . . 145
  and gain scheduling . . . 146
  and inhibit . . . 146
  and sensor break . . . 146
  Enable . . . 58
  Examples . . . 147

Autotune (Cont.)

  Failure modes . . . 151
  Initiation . . . 146
Average Time . . . 48

B

Back to: . . . 123
Background chart colour . . . 30
Backlash . . . 64
Balance Integral . . . 69
Battery
  Backup . . . 132
  Failure . . . 9
  Replacement . . . 163
  Symbol . . . 11
Binary . . . 37
Black wiring editor items . . . 119
Block . . . 48
  Execution order . . . 113
Blue
  Arrow
    Down . . . 125
    Left/Right . . . 123
  Parameters . . . 122
  Wiring editor items . . . 119
Bootrom upgrade . . . 31
Both . . . 37
Boundary 1-2 (2-3) . . . 59
Bounded mode (VPB) . . . 140
Brightness . . . 29
Bring to Date . . . 17
Bring to Front
  Monitor . . . 118
  Monitor context menu . . . 118
  Wire . . . 116

C

Cancel All . . . 17
Cant Clean . . . 70
Capture current values into a data set . . . 125
Carb Act CO O2 . . . 69
Carbon Potential . . . 69
Carbon Potential Control . . . 67
CBH (CBH2) (CBH3) . . . 59
CBH, CBL . . . 141, 145
CBL (CBL2) (CBL3) . . . 59
Cedilla . . . 25
Centre . . . 119
Ch1 (Ch2)
  Control . . . 57
  OnOff Hyst . . . 61
  Output . . . 61, 156
  Pot Brk . . . 61
  Pot Pos . . . 61
  Travel Time . . . 61
  TravelT . . . 145
Ch2 Deadband . . . 144
Ch2DeadB . . . 61
Chain icon . . . 118
ChanAvg . . . 52
Change Battery
  Procedure . . . 163
  Symbol . . . 11

Change Time (Rate of change alarms) 48
ChanMax 52
ChanMin 52
Channel
  Break Response 45
  CJC type 45
  colour 46
  Configuration 42, 46
  Copy 52
  Damping 45
  Descriptor 44
  Error 9
  External CJ Temperature 45
  Input filter 45
  Input high/low 44
  Linearisation type 44
  Main 43
  No. of decimal places 44, 54, 55
  Prefix ('C' or 'V') 13
  PV 44
  Range Low/high/Units 44
  Scale High/Low/Type 44
  Scrolling 7
  Shunt value 44
  Status 44
  Trend configuration 46
  Type 44
  Units 44, 54, 55
Chart colour 30
CJC Type 45
Clean
  Abort 70
  Freq 70
  Frequency 69
  Max Temp 70
  Msg Reset 70
  Parameters 70
  Rcov Time 70
  State 69
  Temp 70
  Time 69, 70
  Valve 69, 70
Click to Select Output 116
Cln
  Enabl 70
Clock
  Failure 9
  Setting 27
CO Local/Remote etc. 70
Cold start 32
Colour
  Channel trend selection 46
  Function blocks etc 119
Column enable/disable 122, 123
Comments 117
  Context Menu 117
Comms Pass 32
Communications 72
  Parameter list 76
  Timeouts 73
Company ID 30
Complete 17
Component Selection 113
Compounds 120
  Create/Flatten 113
Compression 41
Config Revision 30
Configuration
  Alarm 47
  Channel 42
  Counter 55
  Default 32
  I/O 64
  Loop
    Main menu 57
    Output menu 61
    Setpoint menu 60
    Setup menu 57
    Tune menu 58
  Totaliser 53
  Zirconia block 68
ConfRev 52
Connector locations and pinouts 5
Context menu
  Comment 117
  Diagram 119
  Monitor 118
  Wire 116
Control Action 57, 159
Control Loop 1/2
  Enable 29
Control loops 137
  Types of 138
Cool Type 62, 158
Copy
  Comment 117
  Diagram fragment 113
  Fragment to file 119
  Function block context menu 119
  Graphic 119
  iTools components 113
  iTools diagram items 119
  Maths function 52
  Monitor 118
  Parameter 123
  Wire context menu 116
Counter configuration 55
Create a new empty data set 125
Create a new watch/recipe list 125
Create Compound 113, 119, 120
Critically damped 144
CSV 37
  Setup 37
Custom messages 66
Custom note 15
Cut 113
  Comment 117
  Function block context menu 115
  Monitor 118
  Wire context menu 116
  Wiring editor items 119
Cutback 152
  High/low 141
Cutoff High/Low 54, 55

D

Daily 37
Damping 45
Dashed lines 120
Data set creation 124
Data types 73
Database failure 9
Date
  Format 28
  Setting 27
Daylight Saving Time 28
  Active/Inactive 27
DB revision 30
DC input ranges 133
Deadband 159
De-bump 142
Default Config 32
Delete 117
  Comment 116
  Monitor 118
  Wire 116
  Wiring editor items 119
Demand Archive 17
Deriv
  Output 63
  Type 57
Derivative action 139
Descriptor
  Channel 44
  Counter 55
  Group 40
  Maths channels 51
  Totaliser 53
Destination 37
DevBand 47
DevHi 47
Deviation 47
DevLo 47
Dew Point 69
DHCP 35
  Server failure 9
DIA, DIB specificatoin 135
Diacriticals 25
Diagram context menu 119
Digital communications 72
Digital I/O 64
  Assignments 76
DigitalHi 47
DigitalLo 47
Direct Connection (iTools) 110
Disable
  Counter 55
  Totaliser 54
Display 29
  Brightness 29
  Mode
    Horizontal bargraph 21
    Horizontal trend 20
    Loop 22
    Numeric 21
    Selection 15
    Vertical bargraph 20
    Vertical trend 19
Div 52
Down arrow key 7
Download 113
Download the selected data set to the device 125
DST
  Active/Inactive 27
  Enable 28
Duty cycle 162
Dwell 48

E

Edit
  Comment 117
  Wire 123
Eight-input OR block details 169
Electical installation 5
En Rem Gas Ref 69
Enable
  Autotune 58
  Display modes 29
  PFF 62
  Probe cleaning 70
  Promote List 29
  Recording 41
  Tracking 62
  Tuning 58
End Time/date etc for DST 28
Endothermic Gas Correction 67
Eng 57
Engineer Pass 32
Envelope icon 11
Error
  Derivative type 57
  Loop diagnostics 63
  Sched type 59, 143
Ethernet
  Comms spec 132
  Connector location 5
Exception codes 73
Exit History 24
Ext. CJ Temp 45
External CJC 45

F

Faceplate cycling 15, 30
FallROC 47
Fan 62
Fault Response 45
Feature Pass 32
Feedforward 62, 158, 159
  Parameters 62
  Power 62
FF parameters 62
File format 37
Find
  End 116
  Start 116
Firmware
  FTP 31
  USB 31
Fixed IP Address 35
Flash Duration/Size 41
Flash memory full 17
Flatten compound 120

Follow Wire . . . 123
Force Exec Break . . . 116
Forced Output . . . 62, 157
Forward to: . . . 123
From Source . . . 128
FTP
  Archiving lost . . . 9
  Archiving to slow . . . 9
  Icon . . . 11
  Primary/Secondary Server Failure . . . 10
  Server
    Automatic archive . . . 37
    Demand archive . . . 18
    Setup . . . 164
Full page scroll . . . 24
Function blocks
  Details . . . 169
  Supported . . . 135
Function Codes . . . 72

G

Gain Scheduling . . . 143
Gas Reference . . . 69
Gas references parameters . . . 70
Gateway . . . 36
Ghosted wiring editor items . . . 120
Global Ack . . . 71
Go to View . . . 12
Go Up/Down a Level . . . 123
Graphical Wiring Editor . . . 112
Grave accent . . . 25
Green
  Triangle . . . 126
Green wiring editor items . . . 119
Greyed-out wiring editor items . . . 120
Grid, show/hide . . . 113
GrpAvg . . . 52
GrpMax . . . 52
GrpMaxlatch . . . 52
GrpMin . . . 52
GrpMinlatch . . . 52

H

H.Trend Scaling . . . 30
H2 Local/Remote etc . . . 70
Half page scroll
  Trace history . . . 24
Hidden parameters . . . 122
High
  Compression . . . 41
  Cutback . . . 141
  Cutoff . . . 54
  Output
    Tune menu . . . 58
    Tuning . . . 145
High Cut Off . . . 55
History . . . 15
  Background colour . . . 30
  Options menu . . . 24
Hold . . . 62, 157
Home . . . 12
  Page definition . . . 29
Horizontal bargraph mode . . . 21
  Enable . . . 29
Horizontal trend mode . . . 20
  Enable . . . 29
  Scaling . . . 30
HPage Timeout . . . 29
Hysteresis
  Channel alarm . . . 47
  Entry . . . 61
  On/off loops . . . 159

I

In1 . . . 51, 54
In2 . . . 51
Inactive . . . 48
Inertia . . . 64
Info . . . 30
Inhibit . . . 57
Initiate upgrade . . . 31
InOp . . . 63
Input
  Adjust . . . 33
  Filter . . . 45
  High . . . 44
  Low . . . 44
  Timeout . . . 39
  Wiring . . . 5
Input 1 . . . 55
Insert item ahead of selected item (Watch/Recipe) . . . 125
Installation
  Electrical . . . 5
  Mechanical
    Dimensional details . . . 4
    Procedure . . . 3
Instr . . . 39
Integral
  Hold . . . 57, 142
  Term . . . 139
Interface . . . 35
Internal
  CJ temp . . . 45
  CJC . . . 45
Interval . . . 40, 41
  Recording . . . 41
Invert
  DI/DIO . . . 65
  Relay OP . . . 64
IP Address . . . 35
IP Adjust State . . . 44
IP Type . . . 35
Isolation diagram . . . 170
iTools Connection . . . 108

L

Label symbols . . . 2
Language . . . 28
Last Clean . . . 70
Last Day/Hour/Month/Week . . . 17
Last Written on . . . 17
LastMOP . . . 62, 157
Latch . . . 48
LBT . . . 145
LBT (LBT2) (LBT3) . . . 59
Leading paces . . . 25
Limit setpoint rate . . . 154

Limits
Output . . . 156
Setpoint . . . 154
Line voltage . . . 30
Linear . . . 62, 158
Linearisation type . . . 44
Locale . . . 28
Logic I/O specification . . . 135
Logic i/o specification . . . 135
Login . . . 15, 16
Loop
Break . . . 63, 142
Diagnostics display . . . 63
Display mode . . . 22
Display mode enable . . . 29
Main menu parameters . . . 57
Name . . . 57
Output menu parameters . . . 61
PID menu parameters . . . 59
Response . . . 144
Setpoint menu parameters . . . 60
Setup menu parameters . . . 57
Tune menu parameters . . . 58
Loose . . . 39
Low
Cutback . . . 141
Cutoff . . . 54
Output . . . 58, 145
Low Cut Off . . . 55
Lower . . . 61
Key . . . 7
Lp Break . . . 142

M

MAC address . . . 35
Magenta wiring editor items . . . 119
Magnification factor . . . 113
Major Divisions . . . 40
Man
Mode . . . 62
Track . . . 60
Manual
Output . . . 62
Reset . . . 59, 141
Startup . . . 62
Tracking . . . 155
Tuning . . . 151
Master communications timouts . . . 73
Master Conn 2 to 5 . . . 39
Maths channel
Configuration . . . 51
Failure . . . 10
Max Rcov Time . . . 69
Max Rcov time . . . 70
Maximum number of traces . . . 40
Measured Value . . . 45
Mechanical installation . . . 3, 4
Media Duration/Free/Size . . . 36
Media system alarms . . . 10
Messages
Filters . . . 14
Icon . . . 11
On/Off . . . 24
Summary . . . 14
Min Cal Temp . . . 69
Min On Time . . . 144, 162
DIO . . . 64
Relay OP . . . 64
Min Rcov Time . . . 69, 70
MinCalcT . . . 69
Modbus . . . 72
Configuration . . . 39
Input (Maths) . . . 52
Parameter list . . . 76
Alarm summary . . . 77
Channel 1 . . . 79
Channel 2 . . . 80
Channel 3 . . . 81
Channel 4 . . . 82
Custom Messages . . . 83
Digital I/O . . . 83
Group . . . 84
Instrument . . . 84
Loop 1 . . . 86
Loop 2 . . . 88
Network . . . 90
OR block . . . 90
User Lin 1 . . . 92
User Lin 2 . . . 92
User Lin 3 . . . 93
User Lin 4 . . . 94
Virtual Channel 1 . . . 95
Virtual Channel 2 . . . 96
Virtual Channel 3 . . . 97
Virtual Channel 4 . . . 97
Virtual Channel 5 . . . 98
Virtual Channel 6 . . . 99
Virtual Channel 7 . . . 100
Virtual Channel 8 . . . 100
Virtual Channel 9 . . . 101
Virtual Channel10 . . . 102
Virtual Channel11 . . . 102
Virtual Channel12 . . . 103
Virtual Channel13 . . . 104
Virtual Channel14 . . . 105
Zirconia block . . . 105
TCP Port numbers . . . 170
Model . . . 61
Monitor . . . 118
Monthly . . . 37
Motorised valve control . . . 140
Mouse
Pan . . . 113
Select . . . 113
Move selected item
Watch/Recipe . . . 125
MR (MR2) (MR3) . . . 59
Multi . . . 52
mVSbr . . . 69

N

N.acknowledged 48
Name 30
Navigation pushbuttons 7
Network
  Menu 35
None
  Archive (demand) 17
  Automatic archiving Rate 37
  FF Type 62
Non-volatile memory failure 10
Non-volatile parameters in EEPROM 74
Normal compression 41
Nudge raise (lower) 61
Num Sets 59
Number resolution (IEEE) 2
Numeric display mode 21
  Enable 29
Nvol writes 30

O

Offset 44
Oil 62
  Cooling 158
On Media Full 38
On/Off control 138
  Selection 57
OP 59
OP1, OP2 specification 135
OPC 125
Open an existing watch/recipe file 125
Operation
  Maths function 51
  Totaliser 53
OperationCounter 55
Operator
  Notes 15
  Pages - See 'Display modes'
  Pass 32
Options menu 24
OR block 169
Output
  DIO 64
  hi, lo 144
  High
    Output menu 61
    PID Menu 59
  Limits (Output menu) 156
  Loop 156
  Low
    Output menu 61
    PID Menu 59
  PID Gain scheduling type 143
  Rate Limit 157
  Relay 64
  Wiring 5
Over damped 144
Overflow
  Counter 55
Overwrite 38
Oxygen 69
  Exp 69
  Type 69

P

Page key 7
Pan tool 113
Parameter
  Help 118, 123
  Properties 123
Parameters
  Blue 122
  Explorer 121
  PID menu 59
  Serial comms 76
  Setup menu 57
  Tune menu 58
Password
  Configuration 32
  Default 32
  Feature upgrade 32
  FTP server 38
Paste 113
  Comment 117
  Fragment From File 119
  Monitor 118
  Wire 123
  Wire context menu 116
  Wiring editor items 119
Paused symbol 11
PB 145
  Units 57
PB (PB2) (PB3) 59
Percent 57
Period 38, 54
  Averaging 51
Pff En 62
PID
  Control 138
  Loop setup menu 57
  Sets 143
Point1 to Point6 40
PotBrk Mode 61
Power feed forward 158
  Enable 62
Power In 62
Power up 14
PrefMaster Conn 39
PrefMaster IP 39
Preset
  Counter 55
  Totaliser 54
  Val 54, 55
Pri
  mary Server/User/Password 38
  Status 17
Probe
  Fault 69, 70
  Input/offset 69
  State 69
  Status 69
  Type 69
Process factor 69
Promote List 23
  Enable 29
Prop OP 63

Proportional band (PB) 138
Proportional plus integral (PI) 139
Push pin 123
Push to Back
iTools monitor 118
iTools wire 116
PV
Channel 44
Counter 55
Derivative type 57
DI 65
DIO 64
FF Type 62
Frozen 69
Loop 57
Maths channel 51
PID Gain scheduling type 143
Relay OP 64
Sched Type 59
Totaliser 53

R

R symbol 11
R2G 141, 145
Limit 151
R2G (R2G2) (R3G3) 59
Raise 61
Button 7
Range
High/Low 60
Units 44
Rate
Automatic archive 37
PID 61
Working setpoint 60
RateDone 60
Recorder
Dimensions 4
Panel installation 3
Unpacking 3
Recording
Channels included 41
Enable 41
Failure alarm 10
Icon 11
Interval 41
Red wiring editor items 119
Redo 113
Reference 47
Relative cool gain (R2G) 141
Relay
Configuration 64
Pinout 5
Specification 135
Rem 59
PID Gain scheduling type 143
Rem Gas Ref 69
Rem. Output Low (High) 62
Remote
CJC 45
Computer setup (archiving) 38
FF Type 62
Input (PID menu) 59
Output Limits 144
Path 38
Remove recipe parameter 125
Rename Wiring Editor diagram 119
Re-Route
Wire 116
Wires 119
Reset
History 24
Virtual channels 51
Resistance input ranges 134
Resolution
Channel 44
Counter 55
Maths channels 51
Totaliser 54
Zirconia probe option 69
Response Time 39
Rest 61
Restore factory settings 32
RiseROC 47
Rollover 54
RTD types 134

S

Safe 62, 157
Not Acked 47
OP 62
Safety notes 1
Save
After 29
Current watch/recipe list 125
Graphic 119
Saver Brightness 29
SBrk
Mode 62
OP 62
Scale
Divisions 40
High/Low 44
Scan 111
all device addresses 111
Sched
Loop diagnostic parameters 63
Type 59
Screen brightness 29
Scroll key 7
Sec
Password 38
Server 38
Status 17
User 38
Security 32

Select All 119
Selecting components 113
Sensor Break 157
  Type 45
  Val 45
SensorB 63
Sepoint
  Colour 30
Serial
  Mode 39
  Number 30
Server 38
  IP Address 31
ServoToPV 60
Set 59, 143
Setpoint 144, 153
  Access 57
  Limits 154
  PID Gain scheduling type 59, 143
  Rate Limit 154
  Track 60
  Tracking 155
Setting time and date 27
Settling 58
Show Names 118
Show/Hide grid 113
Shunt value 44
Signal wiring 5
Snapshot 124
Soot alarm 69
Sooting alarm 67
Source 31
SP 62
  High (Low) Limit 60
  Int Balance 60
  Rate Disable 60
  Select 60
  Trim 60
  Trim High(Low) 60
SP1 (SP2) 60
Space Evenly 119
Span 46
Specification 131
Stage
  Autotune 58
  Time
    Autotune 58
Standby action 64
Start Day/Month/Time/Week 28
Start On 28
Startup mode 62
State 58
Status
  Alarm 47
  Channel 44
  Counter 55
  Demand archive 17
  Maths channel 51
  Totaliser 54
Step 62, 157
Stop 38
Stopping the tuning process 58
Strict 39
Sub 52
Subnet Mask 35
Supervisory Pass 32
Supply voltage wiring 5
Suspend
  Recording 41
  Schedule 17
Suspended
  Demand archiving 17
  Recording 11
Symbols used on labels 2
System
  Alarms 9
    Display 13
  Message
    Filter 14

T

Tags 116
Target
  Output 63
  Setpoint 57
TCP Ports 170
Td 145
Td (Td2) (Td3) 59
Temp
  Input 69
  Offset 69
  Sbr 69
Temperature Control 67
Terminal torque 5
Termination details 5
Test signal 44
Thermocouple data 134
Three term control 138
Threshold 47
Ti 145
Ti (Ti2) (Ti3) 59
TI Limit 151
Tilde 25
Time
  Format (Modbus) 39
  Remaining 51
  Setting 27
  To Clean 69, 70
  Zone 28
Time Proportioning 162
Timeout 151
Timout
  Communications 73
To
  Destination 128
  SP 58
Tolerance 69
Top level menu 12
Totaliser configuration 53
Trace
  Colour 46
  History 24

Track. 62, 157
Enable 62
OP. 62
PV 60
Val. 60
Transfer between sets 143
Transferring. 17
Trend
Background colour 30
Colour 46
History 24
Trigger. 55
Archive. 38
Tune
Enable 58
Tuning 143
Automatic 145
Manual. 151
Type
Alarm 47
Channel Input. 44
DI 65
DIO. 64
Instrument. 30
of control loop 138
Relay OP 64
Virtual channel 51, 53, 55

U

UHH Compression. 41
Umlaut 25
Unbounded mode (VPU) 140
Undelete 117
Comment. 116
Monitor 118
Wiring editor items 119
Under Damped 144
Undo 113
Unit ID Enable. 39
Units
Channel 44
Counter 55
Maths channel 51
Scaler 54
Totaliser. 54
Unlink
Comment. 117
Monitor 118
Unpacking the recorder 3
Up arrow key. 7
Update rates 133
Upgrade 31
USB
Archive destination 37
Icon. 11
Overcurrent. 10
Port location 5
Port specification 132
Use Tags 116
User linearisation tables 66
User wiring 126
Username 38

V

Values 152
Valve Raise/Lower 64
Version. 30
Vertical bargraph mode 20
Enable 29
Vertical trend mode 19
Enable 29
Virtual channels 51
VPB. 57, 140
VPU. 57, 140

W

Watch/Recipe editor 124
Adding parameters 124
Capture current values into a data set 125
Clear the selected data set. 125
Create a new empty data set 125
Create a new watch/recipe list 125
Data set creation 124
Download the selected data set to the device 125
Insert item ahead of selected item 125
Move selected item 125
Open an existing watch/recipe file 125
Open OPC Scope 125
Remove recipe parameter 125
Save the current watch/recipe list. 125
Snapshot 125
Water 62
Cooling 158
Weekly. 37
Wire sizes 5
Wiring
Electrical 5
Zirconia Probe 71
Failure (system error). 10
Software
Colours (iTools) 117
iTools. 116
Remove wire (user interface) 127
User interface 126
Working
Gas 69
Out High (Low) 63
Output 57
Setpoint 57, 153

Z

Zirconia block option 67
Wiring 71
Zoom 113

This page is deliberately left blank

Eurotherm: International sales and service

AUSTRALIA Sydney
Eurotherm Pty. Ltd.
Telephone (+61 2) 9838 0099
Fax (+61 2) 9838 9288
E-mail info.eurotherm.au@invensys.com

AUSTRIA Vienna
Eurotherm GmbH
Telephone (+43 1) 798 7601
Fax (+43 1) 798 7605
E-mail info.eurotherm.at@invensys.com

BELGIUM & LUXEMBOURG Moha
Eurotherm S.A/N.V.
Telephone (+32) 85 274080
Fax (+32) 85 274081
E-mail info.eurotherm.be@invensys.com

BRAZIL Campinas-SP
Eurotherm Ltda.
Telephone (+5519) 3707 5333
Fax (+5519) 3707 5345
E-mail info.eurotherm.br@invensys.com

CHINA
Eurotherm China
Shanghai Office
Telephone (+86 21) 6145 1188
Fax (+86 21) 6145 2602
E-mail info.eurotherm.cn@invensys.com
Beijing Office
Telephone (+86 10) 5909 5700
Fax (+86 10) 5909 5709 or
Fax (+86 10) 5909 5710
E-mail info.eurotherm.cn@invensys.com

DENMARK Copenhagen
Eurotherm Danmark AS
Telephone (+45 70) 234670
Fax (+45 70) 234660
E-mail info.eurotherm.dk@invensys.com

FINLAND Abo
Eurotherm Finland
Telephone (+358) 2250 6030
Fax (+358) 2250 3201
E-mail info.eurotherm.fi@invensys.com

FRANCE Lyon
Eurotherm Automation SA
Telephone (+33 478) 664500
Fax (+33 478) 352490
E-mail info.eurotherm.fr@invensys.com

GERMANY Limburg
Eurotherm Deutschland GmbH
Telephone (+49 6431) 2980
Fax (+49 6431) 298119
E-mail info.eurotherm.de@invensys.com

INDIA Chennai
Eurotherm India Limited
Telephone (+91 44) 2496 1129
Fax (+91 44) 2496 1831
E-mail info.eurotherm.in@invensys.com

IRELAND Dublin
Eurotherm Ireland Limited
Telephone (+353 1) 469 1800
Fax (+353 1) 469 1300
E-mail info.eurotherm.ie@invensys.com

ITALY Como
Eurotherm S.r.l
Telephone (+39 031) 975111
Fax (+39 031) 977512
E-mail info.eurotherm.it@invensys.com

KOREA Seoul
Eurotherm Korea Limited
Telephone (+82 31) 2738507
Fax (+82 31) 2738508
E-mail info.eurotherm.kr@invensys.com

NETHERLANDS Alphen a/d Rijn
Eurotherm B.V.
Telephone (+31 172) 411752
Fax (+31 172) 417260
E-mail info.eurotherm.nl@invensys.com

NORWAY Oslo
Eurotherm A/S
Telephone (+47 67) 592170
Fax (+47 67) 118301
E-mail info.eurotherm.no@invensys.com

POLAND Katowice
Invensys Eurotherm Sp z o.o
Telephone (+48 32) 218 5100
Fax (+48 32) 218 5108
E-mail info.eurotherm.pl@invensys.com

SPAIN Madrid
Eurotherm España SA
Telephone (+34 91) 661 6001
Fax (+34 91) 661 9093
E-mail info.eurotherm.es@invensys.com

SWEDEN Malmo
Eurotherm AB
Telephone (+46 40) 384500
Fax (+46 40) 384545
E-mail info.eurotherm.se@invensys.com

SWITZERLAND Wollerau
Eurotherm Produkte (Schweiz) AG
Telephone (+41 44) 787 1040
Fax (+41 44) 787 1044
E-mail info.eurotherm.ch@invensys.com

UNITED KINGDOM Worthing
Invensys Eurotherm Limited
Telephone (+44 1903) 268500
Fax (+44 1903) 265982
E-mail info.eurotherm.uk@invensys.com

U.S.A Ashburn VA
Eurotherm Inc.
Telephone (+1 703) 724 7300
Fax (+1 703) 724 7301
E-mail info.eurotherm.us@invensys.com

ED60

©Copyright Invensys Eurotherm Limited 2010

Invensys, Eurotherm, the Invensys Eurotherm logo, Chessell, EurothermSuite, Mini8, EPower, nanodac, Eycon, Eyris and Wonderware are trademarks of Invensys plc, its subsidiaries and affiliates. All other brands may be trademarks of their respective owners.

All rights are strictly reserved. No part of this document may be reproduced, modified or transmitted in any form by any means, neither may it be stored in a retrieval system other than for the purpose to act as an aid in operating the equipment to which the document relates, without the prior written permission of Invensys Eurotherm Linited.

Invensys Eurotherm Limited pursues a policy of continuous development and product improvement. The specifications in this document may therefore be changed without notice. The information in this document is given in good faith, but is intended for guidance only. Invensys Eurotherm Limited will accept no responsibility for any losses arising from errors in this document.

Represented by:

invensys
Eurotherm

HA030554/1 (CN26259)